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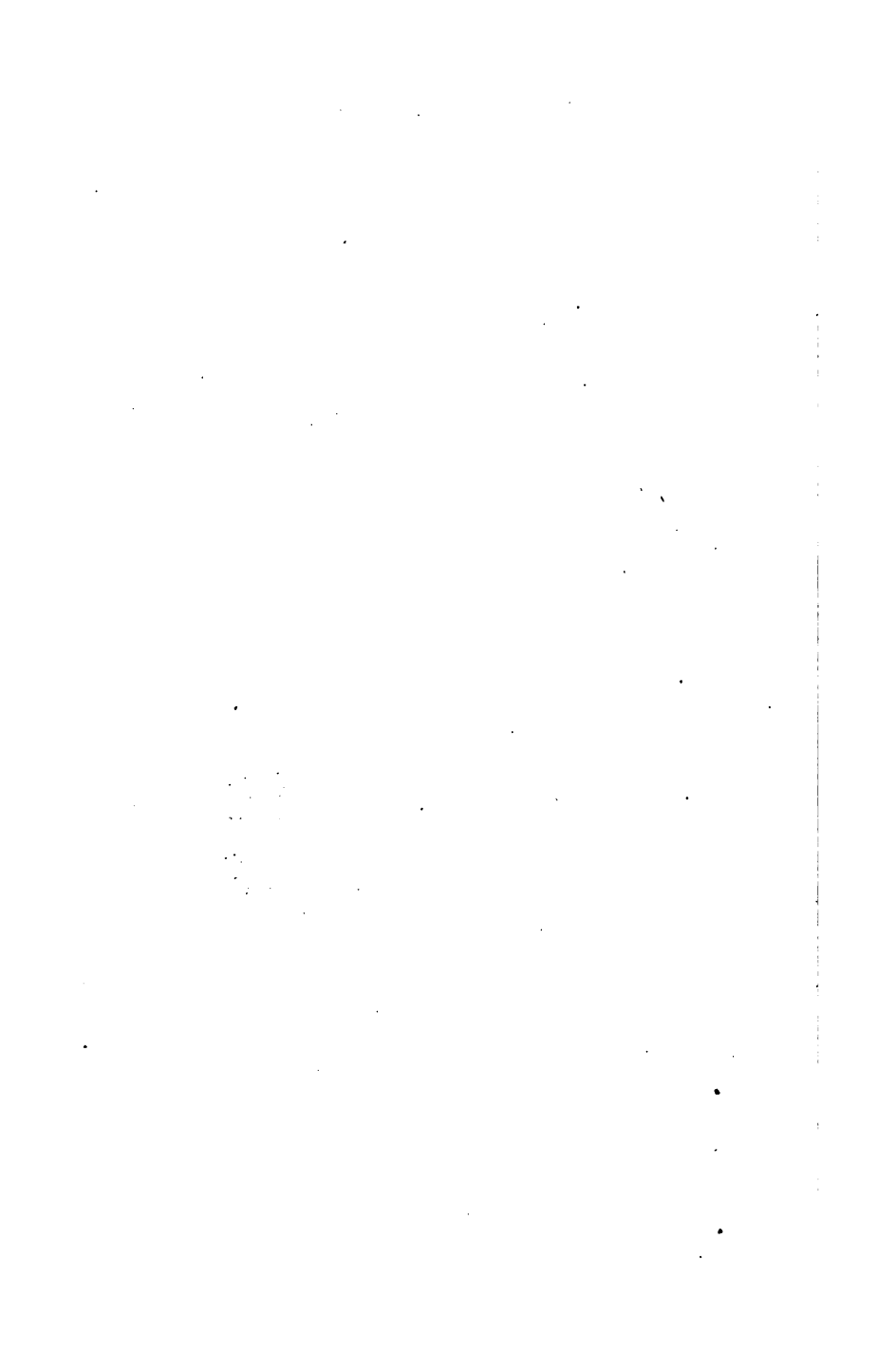
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RUDIMENTS OF ZOOLOGY

ILLUSTRATED

WITH WOOD-ENGRAVINGS



LONDON

W. AND R. CHAMBERS 47 PATERNOSTER ROW

AND HIGH STREET EDINBURGH

1855

18933. f. 1.

Edinburgh :
Printed by W. and R. Chambers.



THE present Treatise on ZOOLOGY is designed to present as much of the science of the subject as might be supposed capable of being learned by young pupils at school and in the parlour. Great efforts have been made to attain conciseness, as well as clearness. The classification followed is a composition of several modern systems, with certain unimportant modifications; and the ascending order is adopted, as best fitted to introduce the subject intelligibly to young students. It is hoped that the work will promote the introduction into general education of a study which is among the most elevating that can occupy the mind of man.



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RUDIMENTS OF ZOOLOGY.

INTRODUCTION.

1. THE solid crust of the earth, with its partial covering of sea, its lakes and rivers, and the impalpable atmosphere which envelops it, is composed of substances and gases having no life. Of external nature, as exhibited to us in the globe which we inhabit, this is the inorganic or inanimate portion. It is susceptible of chemical changes and of mechanical modifications: thus, we can decompose water into two gases, and pound a rock into fragments. But, excepting for these partially and occasionally applied forces, the whole is inert, and, as it were, dead.

2. Strongly distinguished from the inorganic portion of nature, is the ORGANIC, composed of an infinite number of *bodies*, in definite forms, and of definite structure, which possess life, and pass through regular stages of birth, growth, and decay; the earth, its waters, and its atmosphere, being, as it were, a theatre in which these bodies may play the parts assigned to them. One section of these bodies is *Plants*;—living beings deriving nourishment from the earth, water, and air—subject to methodical rules for their reproduction, growth, and decay—and contributing much to the beauty of the external world, but apparently doing so without any consciousness or mental sensation. The other great section presents *Animals*;—beings of a higher grade, possessing not only certain characters belonging to plants, but others besides, which may be comprehensively described as forming a sensational and mental system. Thus, animals become conscious of existence, and are able to perform a great variety of actions. While plants are invariably fixed to some particular spot, animals are, for the most part, detached from the earth, and capable of moving about. The inferiority of plants is further shewn in their being necessary to animals as food. Certain animals feed on plants; certain other animals

of higher character feed upon those which live on plants. Thus, there is a clear gradation of existences—from the inert substances of inorganic nature, to plants which live, but do not feel or move about; from them, again, to phytophagous or plant-eating animals, possessing not only life, but sensation and intelligence; and, finally, from these to carnivorous or flesh-eating animals, which exhibit generally a higher mental activity. Taken altogether, it is a wondrous system, of which all the parts are in perfect harmony, shewing the most incontestable proofs of its having been planned and created by a Being of supreme wisdom.

3. An organic being is so called because, in its definite structure, there are *organs*—that is, parts possessing certain *powers*, and exercising certain *functions*, necessary in the economy of the being. Thus, for instance, we have a stomach to digest food; a heart to propel the blood formed from the food on its course through the system; and lungs by which we perform the act of respiration. All of these are *organs*, or instruments. So constituted, an organic being is evidently superior to a stone or a clod of the field; but with its delicacy and beauty of constitution comes destructibility. It is liable to be mechanically injured and shattered, so that the living functions can no longer be performed; and, even when no such accident happens, it becomes in time worn out by its own constant action. A reproduction of organic beings is, therefore, necessary to their being maintained in integrity of form and sufficiency of numbers on the face of the earth. Hence, in short, birth, growth, and death, come to be essentially connected with organic nature. So admirably, however, has the Creator arranged the whole economy of the organic world, that life appears everywhere to go on in one incessant flow.

4. The animal part of creation is composed of an immense variety of beings, of very various degrees of complexity of organisation and intelligence, as well as of bulk. To ascertain and describe their internal organisation, is the purpose of the science of ANIMAL PHYSIOLOGY, which is treated in another volume of the present series, and therefore need not detain us here. To classify animals according to their outward characters and habits, is the aim of the science of ZOOLOGY (a term composed of the Greek ζῷον, an animal, and λόγος, a discourse).

5. By outward characters are meant those peculiarities of structure which most conspicuously distinguish animals. Judging by these characters, we can see that some are greatly inferior to others—made, as it were, upon a simpler pattern: for example, worms are simpler than insects, and therefore inferior to them; so, likewise, are fishes simpler than and

inferior to poultry and cattle. Hence arises a *gradation* amongst animals, though not of a kind as yet thoroughly ascertained or understood. We can see, however, one clear *principle* in the ranking of animals; namely, that where there are many repetitions of one organ or feature—as, for instance, in the feet of the centipede, or the rays of the feather-star—it is a mark of inferiority, while it is equally true that the concentration of any branch of organisation is a mark of elevation in the scale. We can also trace *affinity*, or resemblance, among certain groups of animals, shewing them to be, as it were, comparatively near relations to each other. For example, among those called birds, or those called insects; and also more closely in smaller groups—as crows among birds, or beetles among insects. On gradation and affinity are based all attempts to classify animals.

6. The first and most important term employed by the zoologist is *species*, as applicable to a certain form and certain characters which remain permanent in successive generations. Thus, the sheep is a species. The honey-bee, also, is a species. The zoologist aims at giving each species of animals a name by which it may be distinguished.

7. To a number of species having kindred characters, he applies the term *genus*—meaning a kind. A number of genera, again, with more general characters of resemblance, are usually grouped as an *order*. For example, the Ruminant Animals—cattle, deer, &c.—form an order. Sometimes, however, a group of genera having certain traits in common, is called a *family*—for example, the crow, jay, black-bird, &c., form the family *Corvidæ*. In these instances, a group of families constitutes an order. A *class*, again, is a combination of orders; for instance, Birds are a class. Thus, we come to very general characters; but there are some still more general, according to which we divide the entire Animal Kingdom into four *sub-kingdoms* or *provinces*. Thus, we have Provinces, Classes, Orders, Families, Genera, and Species—each term, in succession, being applicable in a more and more particular way than its predecessor. Nor is species the last and most particular term, for in many species there are *varieties*. These, however, are regarded as only the transient effect of the conditions in which the species may live.

8. The four Provinces of the Animal Kingdom are:—

- I. RADIATA, or RAYED ANIMALS.
- II. MOLLUSCA, or PULPY ANIMALS.
- III. ARTICULATA, or JOINTED ANIMALS.
- IV. VERTEBRATA, or BACKBONED ANIMALS.

It is according to these four principal forms that all animals

appear to have been modelled—the subordinate divisions being merely slight modifications, founded on the development or addition of certain parts which produce no essential change on the plan itself.

PROVINCE FIRST.—RADIATA.

9. This sub-kingdom was so named by Cuvier, because many of the animals included in it are more or less radiated in plan; that is, exhibit rays or branches. Of all animals, they exhibit the lowest degree of organisation. They are wholly confined to a watery medium or sphere of existence. On account of the obscure form which the nervous system takes in them, some naturalists have proposed for them the name *A'crita* [*ἀκρίτες*, undiscernible]. A number of them, apparently hovering in character between plants and animals, or externally resembling plants, are called Zoophytes (*plant-animals*).

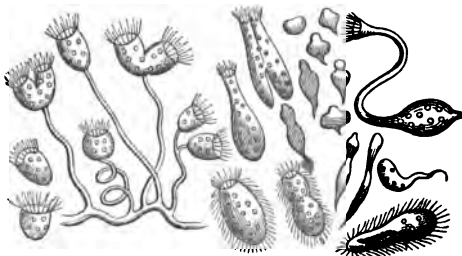
10. The *Radiata* are divided into five classes—Infusoria, Polypi, Acalephæ, Entozoa, and Echinodermata.

CLASS INFUSORIA.

11. The INFUSORIA are microscopic animalcules; that is, animals so small that they cannot be seen without the aid of the microscope, an instrument which magnifies small objects to several hundred times their actual bulk. In all stagnant water, or in any water in which vegetable or animal matter has been infused and allowed to decay, these minute animals are found, being, it is supposed, developed from *ova*, or germs conveyed thither by obscure means. Besides the orders here enumerated, there is a large family of objects, called *Diatomaceæ*, which are not yet with certainty referred to the Animal Kingdom. They consist of single cells, in cases of siliceous or flint, of numberless forms, found living and moving in all water which has been exposed to the air, and dead in the mud of rivers, in guano, and in many alluvial deposits.

12. ORDER POLYGASTRICA are the most minute of the ascertained infusory animals. While some species are naked, others are clothed in silicious cases; and it has so happened in the history of the world, that thick strata have been composed of the hard exuviae of these humble creatures. Though individually invisible to the naked eye, these animals,

by their immense numbers, impart a distinct colour to the water in which they swarm, and they are one of the causes



Various forms of Animalcules.

of the phosphorescence of the sea. The order includes two families—*Urcularia* and *Cercarea*.

13. ORDER ROTIFERA.—These have a gelatinous body, of an oval shape, with a mouth and a stomach. About the head there is a very singular organ, variously divided into tubes with toothed edges, which vibrate in various ways, and when viewed under the microscope, have the appearance of one or more toothed wheels revolving with greater or less rapidity. This organ, from which the order derives its name, is supposed to be in some way connected with the function of respiration. The Rotifera are so exceedingly minute, that a drop of water is to them as a lake in which they may disport themselves.



Rotifera.

CLASS PHYTOZOA.

14. The PHYTOZOA are so named from their external resemblance to plants: they are otherwise called Zoophytes (Animal Plants) and Polypifera. The general character is that of a small animal or polype, consisting of a stomach, and a mouth surrounded by tentacula (organs for holding); but this character is found in many special forms, and in various connections, constituting great differences.

15. ORDER HYDROIDA have for their fundamental type the *hydra*, a simple polype, usually seen enjoying an independent existence, attached by a stalk to some twig or other object, in stagnant water. The hydra seldom exceeds an inch in length,

but is sometimes as long as six inches. The body is wholly gelatinous, consisting only of a kind of bag, which serves as a stomach, with a circle of long arms or tentacula round the



Hydra.

mouth, and no other outlet for the refuse of the food. 'Small larvæ, worms, and entomostracous insects seem to be their favourite food; and to entrap these, they expand their tentacula to the utmost, and spread them in every direction, moving them gently in the water to increase their chances. No sooner is their prey laid hold upon, than it evinces every symptom of painful suffering; but its violent contortions are momentary, and a certain death suddenly follows its capture. How this effect is produced, is mere matter of conjecture, as not even

a wound can be perceived on the dead animal.'

16. In another family, *Tubulariæ*, we find a tendency to the consolidation of the exterior into a kind of horny tube or sheath; and when a number of polypes are associated together, a compound structure is produced. Instead of the foot of the hydra, we have here a horny tube, in which the lower part of the body of the animal is placed, and which, being connected with its organisation, has an independent vitality. In a third family, *Sertulariæ*, the polypes reside in small horny cases, which are connected with each other in much the same manner as the branches of a plant.



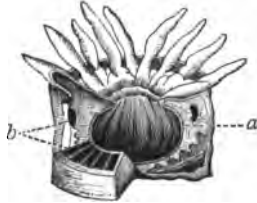
Portion of Sertularia: a, a, polype-cells with polypes; b, b, ovarial vesicles.

17. ORDER HELIANTHOIDA—so named from their resemblance to the popular pictures of the sun and his rays—consists of a variety of fleshy polypes, which have the power of fixing themselves by the base, though many of them also crawl, and allow themselves to be moved along by the current of the water. The family *Actiniidæ* (ἀκτίς, ray, and ἴδιος, form) have the body of a soft gelatinous texture, and often brilliantly coloured. Their tentacula are arranged in several rows around the mouth, having the appearance of full-blown many-petaled flowers, whence they are called sea-anemones and sea-sunflowers. They are among the most highly organised of the class, and feed on shell-fish, and other marine animals, which they draw into the mouth with their tentacula, disgorging shortly afterwards

the shells and indigestible parts. 'They are very sensitive to light, and expand or close their tentacula according to the fine-



Actinia seen from above.



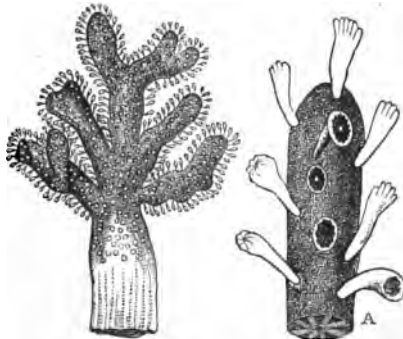
Section of Actinia : a, cavity of stomach; b, surrounding chambers.

ness of the day. When the feelers are drawn in, the aperture from which they proceed closes like the mouth of a purse, and the animal appears like a simple fleshy tubercle adhering to the rock. The species most common in Europe is the *Actinia senilis*. It is about three inches wide, with a leathery envelope of an orange colour, and it has two circular rows of tentacula of moderate length.

18. The *Lucernaria* (*lucerna*, a lamp) resemble the former family, but their substance is softer. They have a long slender pedestal supporting a radiated disk, which expands like a parasol, and is surrounded by numerous tentacula, united in bundles. Their name is derived from the phosphorescent light they emit.

19. ORDER ASTEROIDA shew us the individual polype sinking,

as it were, under the compound form. One noted family, *Alcyonidae*, are of a spongy character. They are well known on our coasts under the name *dead-men's-fingers*, and others, referring to their flabby character and the forms they present. What seems a disgusting fleshy mass in the fisherman's net, proves to be, when placed at ease in its proper element, a structure of wonderful beauty. The mass is traversed by a multitude of



Alcyonium : A, portion enlarged, shewing the polypes.

be, when placed at ease in its proper element, a structure of wonderful beauty. The mass is traversed by a multitude of

minute canals, terminating in prominences, from which the polypes protrude.

20. In the *Pennatula*, or Sea-pen, we see the asteroid zoophyte



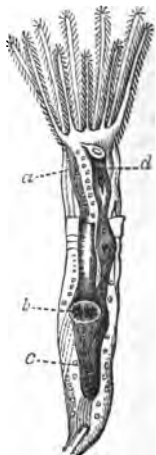
Pennatula.



Single Polype of
Pennatula.

acquiring solid parts. It has a stony axis, flexible at the extremity, and from which a regular series of lateral branches passes off on each side, like the barbs of a feather, each bearing a polype. This genus has a special interest for the geologist, as one of the earliest of fossils, the *graptolite*, evidently belongs to it.

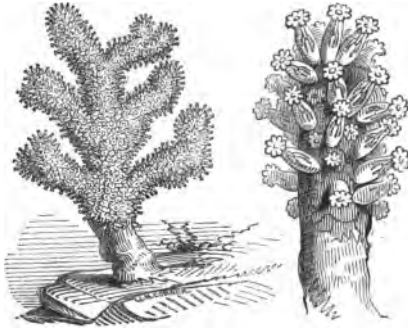
21. ORDER ASCIDOIDEA—called also Bryozoa—comprehends several families and many genera; but it may be sufficient in this place to advert only to a noted species—the *Bowerbankia*. From a sort of creeping stem arise separate polypes, each enclosed in a horny transparent sheath, with ten long and slender tentacula surrounding the mouth. The cesophagus or gullet terminates in a cavity analogous to a gizzard, having thick muscular walls, lined with tooth-like processes. Below this is the true stomach, from which a tube ascends to an outlet near the mouth. The whole economy of this animal, its feeding and lively movements, form a most interesting microscopic study for the naturalist. It has latterly been concluded that the Bryozoa, though bearing a general resemblance to polypes, are entitled to a higher place in the scale of creation. Under the names Foramenifera, Linulites, &c., their microscopic shells are found in enormous abundance in chalk and limestone.



Bowerbankia: a, cesophagus; b, gizzard; c, stomach; d, orifice of intestine.

22. ORDER PORIFERA might be generally described as compound polypes, the individuals being connected by a membrane extended over an internal

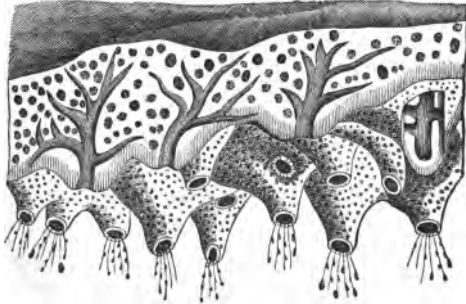
massive structure, calcareous or horny in its character. In one large family this internal structure is the substance called *coral*; in others, it is that no less familiarly known as *sponge*. The material of coral is secreted and deposited by these



Coral.

animals, and the hugeness of the masses which it forms in some oceans is one of the most wonderful facts in natural history. Extensive reefs and considerable islands in the South Sea are composed of coral, the product of these minute polypes; and the formation named Mountain Limestone, is believed to have originated in the same manner.

23. On carefully examining the Sponge, it is seen to contain



External surface and sectional view of Living Sponge.

a number of minute orifices or pores, extending in channels through the substance. In a living state, when enveloped in

membrane, the only vital action that can be traced is a continual passage of water into and out of these channels, being probably for the purpose of supplying the animal with nourishment. In some species, the vents are at the extremities of small protuberances, so that the issue of the water is somewhat like the eruption of a number of volcanoes, but in a downward direction.

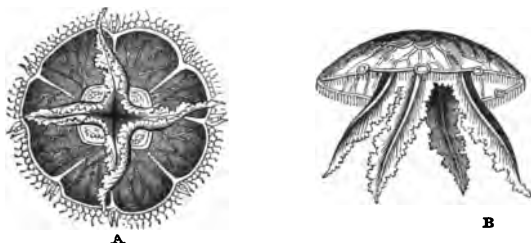
24. In this humble department of creation, the animals are reproduced, not merely by *ova* or germs prepared within the body of the parent, but in various other ways. 'Reproduction by buds [*gemmiparous reproduction*] occurs among the polypes and some of the infusoria. On the stalk, or even on the body of the Hydra, and of many infusoria, there are formed buds, like those of plants. On close examination, they are found to contain young animals, at first very imperfectly formed, and communicating at the base with the parent body, from which they derive their nourishment. By degrees the animal is developed; in most cases, the tube by which it is attached to the parent withers away, the animal is detached, and becomes independent. Others remain through life attached to the parent-stalk, and in this respect present a more striking analogy to the buds of plants.

25. 'Reproduction by division, or *fissiparous reproduction*, is still more extraordinary. A cleft or fissure at some part of the body takes place, very slight at first, but constantly increasing in depth, so as to become a deep furrow; at the same time, the organs are divided, and become double; and thus two individuals are formed of one—so similar to each other, that it is impossible to say which is the parent and which the offspring. The division takes place sometimes vertically, and sometimes cross-wise. In some infusoria, this division occurs as often as three or four times in a day.'—AGASSIZ. As already implied, these modes of reproduction are only additional to the universal mode by germs or *ova*.

CLASS ACALEPHÆ.

26. ACALEPHÆ (ἀκαλήφη, a nettle) are so called from the property many of them possess of irritating and inflaming the skin, the cause of this property being still undiscovered. Cuvier divided the Acalephæ into two Orders, marked by the possession or non-possession of an air-bag to sustain them in the water, calling the former *Hydrostatic* and the latter *Simple*. More recent inquirers arrange them in four groups, named from peculiarities of structure, *Pulmonigrada*, *Ciliograda*, *Cirrhi-grada*, and *Physograda*. The most important forms are the *Medusa*, or common jelly animal, the *Berœe*, and the *Physalia*.

27. *Medusa*.—The body of this creature is in the form of a gelatinous disk, more or less convex on the upper surface, somewhat like the head of a mushroom, and termed the umbrella. From the centre of this, and from the margin, there depend in most of the species tentacula, more or less numerous, and more or less elongated. When the *Medusa* is



Medusa.

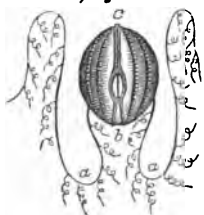
A, under surface, shewing the mouth in the centre, surrounded by the tentacula, and the ovular chambers exterior to the origins of these; B, side-view, shewing the tentacula hanging down in their natural position.

seen dead on the beach, it appears as a piece of coarse jelly, and it is difficult then to imagine how lively and beautiful are the movements of the living animal, as it advances through the water in search of prey.

28. The solid parts of the *Medusa* form so small a proportion of its frame, that if a specimen of ten poundweights be put upon a filter, what remains after the fluid parts, which are chiefly sea-water, have escaped, does not exceed two drachms in weight! Yet though they are so very soft, they feed upon prey of firm structure—such as crustacea, and other marine animals of much higher organisation than themselves, which,

being probably overcome by their stinging power, are quickly seized and dissolved in their stomachs. Many of the species of medusæ are phosphorescent, and shine in the gloom of night like globes of fire. Professor Jones, who had more than once observed this phenomenon, says that the light is not constant, but only emitted when agitation disturbs the medusæ.

29. *Berœ*.—The species of this family have globular bodies provided with salient bands, extending from the centre of the upper surface to that of the under, and bristled with cilia or filaments, by which their motion through the water is effected.



Berœ: *a a*, tentacula; *b*, mouth; *c*, termination of intestine.

One species, the *B. pileus*, which is understood to constitute a great portion of the food of the common whale, is frequently seen in the English Channel. It has the appearance of a bright globe of jelly, about half an inch in diameter.

30. *Physalia*.—The animals of this family have an oblique and wrinkled salient crest on the upper surface, and are furnished below, near one of the ends, with a number of cylindrical appendages. They float upon the surface of the sea when smooth, and the crest answers the purpose of a sail. They are commonly called Portuguese men-of-war, and are often seen in hundreds floating along with the Gulf Stream and other currents of the ocean.



Physalia.

CLASS ENTOMOZOA.

31. The ENTOMOZOA (*εντός*, within, and *ζῷον*, an animal) are almost all parasitical on the intestinal organs of other animals. Many of them infest various parts of the human body—as the intestinal tube, the bronchial glands, the kidneys, and the voluntary muscles; and the injury they occasion, when their numbers become excessive, is well known. The habits of

intestinal worms are as obscure as their habitations; and the purpose they answer in the economy of nature is quite a mystery. They have colourless blood, circulated in the higher species in a closed system of vessels, without an auricle or a ventricle. They have no visible respiratory organs, no articulated members for locomotion, and no organs of sense. This class admits of subdivision into two Orders—*Nematoidea*, Round-worms, having the intestine floating in a distinct abdominal cavity; and *Parenchymata*, with viscera obscure.

32. ORDER NEMATOIDEA (*νήμα*, a thread, and *ἴδιος*, form), or Rounded Worms, consist of only one family—the Thread-worms (*Filaridæ*). They are so called on account of the body being long, slender, and threadlike. They are not found in the open cavities, but are imbedded between the coats of the viscera, and in similar situations. They are not confined to the larger animals, but are found also in insects and their larvæ, as well as in various mollusks.

33. The species of thread-worm most dreaded by man is the Guinea-worm (*Filaria medinensis*), which insinuates itself under the skin, generally of the leg, and frequently causes great agony and convulsions. It is about equal in size to a pigeon's quill, and is peculiar to hot countries. The genera of thread-worms, besides the *Filaria* proper, are *Tricocephalus*, *Ascaris*, *Strongylus*, and *Lerneæ*.

34. The ORDER PARENCHYMATA have cavities for the reception of food, carved out, as it were, of the soft, almost homogeneous, tissues of their bodies. Some of them are of eel-like form; such are the so-called *eels* in vinegar, and certain little parasites found in the muscles of man. To this group also belongs the *Tenia* or tape-worm, a creature composed of an indefinite series of parts, all connected by one alimentary canal, but having reproductive organs on each part, and which has been known to reach fifteen feet in length. A head, with four mouths, surrounded by a double circle of small hooks, enables the animal to attach itself to a nourishing surface; and should all the parts except a small number be broken off from the head, new ones will be formed, and the individual animal will continue to live.

35. One of the most simple of all the entozoa is the *hydatid* or *acephalocyst* (headless bag), a mere sac or stomach with a mouth, which infests the liver and other organs of various animals, including the human species. The young hydatids grow in the interior of the parent, which perishes when they come to maturity. Allied to this animal is the *distoma* or *fluke*, which infests the liver of sheep, and gives rise to severe

disorders. The *Planaria* is a similar parasite, but residing in the water, where it attacks the surface of various animals. In the forepart of its body are two specks, believed to be eyes; a sucker, or mouth, is in the centre; and the reproductive apparatus is behind. Each of these parts, when separated, speedily becomes a complete animal.

CLASS ECHINODERMATA.

36. ECHINODERMATA (*ἑχίνος*, urchin, and *δέρμα*, a skin), or Spiny-skinned Animals, are so called because they have a crustaceous or coriaceous covering, generally armed with tubercles or spines like that of the hedgehog. They are all marine, and in their adult state move freely about. There are two Orders: those with feet or vesicular appendages, answering the same purpose; and those without them. These are respectively termed *Pedicellata* and *Apoda*.

37. ORDER PEDICELLATA (*pedicellus*, diminutive of *pes*, foot) consist of three well-defined families—Star-fishes, Sea-urchins, and Sea-slugs.

38. The family of Star-fishes, *Asteriadae* (*ἄστέρας*, a star), are so called because the body is generally in the form of a star, with five rays springing from a central disk, in the middle of the lower side of which the mouth is situated. The framework of the body is composed of horny plates, variously arranged. In those species which have distinct rays, there is a longitudinal groove on the upper

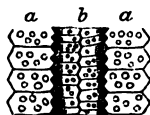
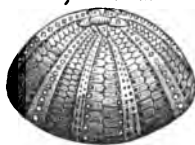


Asterias: upper surface.

surface of each ray, with perforations on both sides. Through each orifice, the animal can protrude a tubular organ, capable of adhering to the surface of any body. These enable them to draw prey towards their mouth, and are also subservient to the purpose of locomotion. Professor Rymer Jones says: 'If the common star-fish of our coast, which, when it is left by the retiring waves, appears so incapable of movement, be placed in a large glass jar filled with its native element, hundreds of feet will gradually protrude, and fix themselves to the sides of the vessel as the animal begins to march.' The entire surface of the star-fish is covered with pores, leading to small tubes, which admit water probably for the purpose of respiration. They feed upon

almost any organised substance, living or dead, that falls in their way.

39. The family of Sea-urchins or Sea-eggs (*Echinidæ*) have the body covered with a crust of calcareous matter, in segments nicely adapted to each other, and perforated by regular rows of holes for the membranous feet; and the mouth, as in the star-fish, is generally directed downwards. Their food is of a mixed character, consisting of crustacea and sea-weed. The most common of the sea-urchins, properly so called, is the *Echinus esculentus*. This species, which is found in all European seas, equal in size to an ordinary apple, is closely set with short spines, and is generally of a violet colour.



Shell of *Echinus*: a, a, tubercular plates; b, ambulacral plates.

40. The family of Sea-slugs (*Holothuridæ*) have an oblong body, resembling a cucumber, with a leather-like covering open at both ends. In tropical seas they are very numerous, and many of them are splendidly coloured. Some of the species are edible, and, when dried, are the trepang of commerce. By the Malays they are diligently sought after, for the supply of the China market.

41. ORDER APODA resemble the *Holothuridæ* in form, but want the feet (*ἄπους*, without feet); and their leather-like skin is quite unarmed. In their movements they resemble worms; some are found under stones, while others burrow in the sand.

PROVINCE SECOND.—MOLLUSCA.

42. THE term *Mollusca* (from *mollis*, soft) was applied by Cuvier to a large department of the Animal Kingdom, composed of animals having no skeleton, internal or external, but possessing soft bodies, usually enclosed for protection in a shell. The muscles are simply attached to various parts of the skin, and by alternate contractions and expansions of that covering, enable the animals to creep, climb, swim, burrow, and seize upon various objects, according as the form of their parts may permit. Mollusks, however, are generally sluggish in their movements.

43. The greater number of Mollusks are constant inhabitants of the sea; many, however, live in fresh water, and some dwell upon the land. Their blood is pale, and never truly red. Nearly all of them have an extensive fold of the skin reflected over their body, which it covers like a mantle. It is sometimes extended into a breathing-pipe, or branched and divided in the form of fins. When the covering is simply membranous or fleshy, or when a horny or testaceous rudiment of a shell is developed, but remains concealed in the substance of the mantle, the mollusk is said to be *naked*. When the shell is so much enlarged that the contracted animal finds shelter beneath it, the species is said to be *testaceous*.

44. The nervous system of the Mollusca is unsymmetrical, being composed of a ring enclosing the gullet, and connected with ganglia or nervous masses in other parts of the body.

45. Some of the Mollusca are exceedingly small; so much so, that they will pass through holes pricked in paper with a needle. Others are of large bulk; the *Tridacna* or Clamp-shell, for instance, reaching the weight of 500 pounds. Some of them are of humble organisation, verging on the character of the radiated tribes; others, again, possessing the rudiment of a skeleton, are considered as making an approach to the Vertebrata. The shell is a membrane, composed of minute cells, in which is deposited calcareous matter, the whole being secreted from certain portions of the organisation of the animal. It is either in one piece, or in two, giving rise to one leading term of classification—namely, *univalves* and *bivalves*. The bivalve mollusks are the humbler of the two divisions; from being deficient in a head, they are comprehensively termed *Acephala* (*ἀκεφαλος*, headless, from *α*, privative, *κεφαλή*, the head).

46. The formation of the shell is a curious process, depending

entirely on the mantle, the membranous layer which invests the body of the animal. The margin of this integument is provided with glands, and sometimes also with a fringe of minute tentacula. The animal, extending the border of its mantle to the border of the shell, deposits there a fresh layer of cells, containing calcareous matter; thus, layer after layer, it extends its living mansion, in just proportion to its own growth. And to this process it must have a strong instinctive tendency, as even a starved oyster has been observed to make an effort for the forming of fresh shell. The border of the mantle contains, in some species, patches of colouring matter, secreted in glands, and the shell becomes variously coloured accordingly. Ridges and spines, projecting from the general outline of the shell, are produced by corresponding expansions of the mantle. After the coloured exterior deposit has been formed, the animal thickens it by an interior lining, formed of matter secreted from a different portion of the mantle, and nacreous (mother-of-pearl) in its character. Should any particle of sand have intruded, or any predaceous enemy attempt to bore through the shell, the deposition of nacreous matter is increased at that spot, till a globular prominence is formed, presenting beautiful iridescent colours. Such is the history of the formation of those *pearls* which have long been so well known as ornaments.

47. The Mollusca are divided by Agassiz into three Classes—*Acephala*, *Gasteropoda*, and *Cephalopoda*.

CLASS ACEPHALA.

48. ORDER TUNICATA.—These are characterised by having the body covered with an elastic cartilaginous tunic, which appears to serve in place of a shell. They are very humble animals, often found associated in strings and clusters, generally unattractive in form, but in some instances transparent and beautiful. One family, the *Ascidians*, has been a favourite subject of study with naturalists. They possess a gill-sac, in which the seawater is driven about for purposes of respiration, while the minute particles of food which it contains are at the same time propelled into the stomach. Another curious peculiarity is in the circulation; for after the blood has been sent out for a time by one set of vessels, and received back by another, the process is reversed; and so on

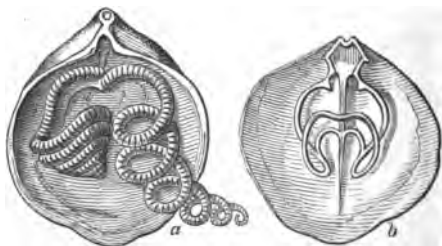


Ascidia Australis :
external aspect.

alternately. Many of the Tunicates have a remarkable power of ejecting the sea-water with force from their bodies, and the descriptive term *Squirters* has consequently been applied to them.

49. Among the *Salpæ*, a family of the Tunicata, was first observed the singular phenomenon called *alternate reproduction*. These humble animals, while floating in long chains in the sea, produce each an egg, from which comes a creature, different in form from the parent, and which lives solitarily. This little animal, in its turn, propagates by a kind of budding, which gives rise to chains seen within the body of the parent, and these again bring forth solitary individuals. Thus each animal resembles, not its parent, but its grandparent.

50. ORDER BRACHIOPODA (Arm-footed) are so called because of their possessing two long ciliated arms, supposed to be used for creating currents, by which food may be brought to the mouth. The valves of their shell are not connected by a hinge, as in the higher acephalans, but by means of certain muscles of the animal's body, by which they are brought together like the boards of a book. The Brachiopoda are dwellers in deep water, are widely diffused over the earth, and make a conspicuous appearance in the earliest fossiliferous strata. The genera *Lingula* and *Terebratula* are fixed by means of a fleshy footstalk to submarine bodies. In *Orbicula*, the pedicle is wanting, and the lower valve of the shell becomes



Terebratula :

a, valve with the spiral arms; b, valve with arms removed.

itself the means by which the attachment of the animal to the rock is effected.

51. ORDER LAMELLIBRANCHIATA (Plate-shaped Gills), or *Testaceæ*; also named *Conchifera*: the two latter names referring to the shells by which they are covered. In this order are included the great mass of bivalves familiar to common observation—as the oysters, muscles, cockles, &c. The

most conspicuous peculiarity is the *branchiæ*, or breathing apparatus, forming a double fringe to each lobe of the mantle, and neatly arranged within the margin of the shell. Another is the *adductor muscle*, by which the animal can draw the valves of its shell close together when it apprehends danger. The shell of a conchifer, unlike that of the brachiopod, has a hinge, which often remains in good condition long after the death or removal of the animal; in some instances, it is made stronger by having *teeth* which lock into each other. In many of the conchifera, there is also a fleshy muscular organ called the *foot*, passing out between the edges of the mantle, and serviceable as a limited means of locomotion.

52. The Oyster family (*Ostrea*).—The edible oyster, *Ostrea Edulis*, has, as Professor Forbes remarks, its capital in Britain; for, though found elsewhere on the coasts of Europe, both northwards and southwards, nowhere does it attain such perfection as in our seas, through which it is generally distributed—sparingly in some places, abundantly and in gregarious assemblages in others. The oyster is deficient in a foot, and is fixed to the sea-bottom, where it resides, by the shell alone. It employs its branchiæ, and the minute cilia with which these are covered, in making currents in the water for the purpose of bringing animalcules to its mouth, which is situated near the hinge, under a kind of hood formed by the edges of the mantle. The ancient Romans valued our native oysters even as we do now, and must have held them in higher estimation than those of the Italian shores, or they would not have brought them so far for their luxurious feasts.



Oyster.

53. In the month of May, the oysters cast their spawn, which the dredgers call the *spat*. It cleaves to stones, old oyster-shells, and pieces of wood, at the bottom of the sea. It is conjectured that the spat in twenty-four hours begin to have a shell. The oyster is considered full grown for the market when

from four to seven years old. Until the third or fourth year, each annual growth is easily observed; but after their maturity, it is difficult to count the layers. Aged oysters become very thick in the shell.



Anomia Ehippium.

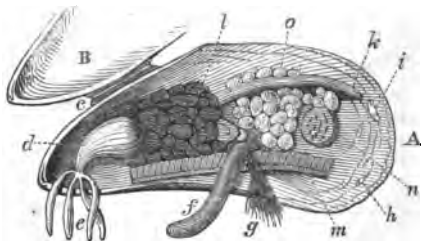
54. The *Anomia* are nearly allied to the oysters, but have a remarkable peculiarity in the structure of the shell. The greater part of the adductor muscle passes through a fissure in one of the valves, to be attached to a third plate, sometimes shelly and sometimes horny, by which the animal adheres to foreign bodies; the remainder joins one valve to the other.

55. The *Pecten*, so called from the resemblance of the shell to a certain kind of comb, forms the type of a family intimately connected with the oyster, but of higher organisation, being provided with a well-developed foot, and having eye-specks.



Pecten.

56. The Muscle family (*Mytilaceæ*) are well represented by the common muscle (*Mytilus Edulis*), which is found in great abundance on our shores, usually near the mouths of rivers. Some species are inhabitants of fresh water; and one of these, the *Unio*, is noted for producing small pearls. The foot of the muscle is



Interior of Muscle : A, right valve; B, left valve; c, hinge; d, stomach; e, tentacula; f, foot; g, byssus; h, branchial orifice; i, vent; k, termination of intestine; l, liver; m, gills; n, adductor muscle; o, ovary.

provided with a collection of hair-like filaments (the *byssus*), by which it attaches itself to solid objects. This curious arrangement, and the other principal parts of the organisation of the muscle, are depicted in the prefixed engraving. Belonging to this family are some remarkable boring mollusks, which have the power of penetrating hard rocks, and making deep holes, which are enlarged as they advance, in accordance with the growth of the animals, and which, therefore, they cannot quit. No mechanical means for producing this effect are observable, and it may be conjectured that the process is of a chemical character.

57. The Clam, or Spiny Oyster family (*Spondylidae*), are inhabitants of the Mediterranean and the warmer seas, and are found at various depths attached to coral rocks and dead shells. Their shells, the upper valve of which is armed with spines, are often tinged with lively colours. Several splendid species are found within the tropics.

58. The Cockle family, *Cardiaceæ* (*cardium*, a cockle), are of numerous species, and the shells of many of them are very beautiful. The animal is characterised by having the mantle open anteriorly for the foot, and the shell by having at the hinge irregular primary teeth, generally accompanied with two lateral ones. Cockles are enabled by a large development of the foot to burrow in the sand of the sea-shore.

59. *Myidae*.—The shell in this family usually approaches the cylindrical form, having a strong hinge, and open at the two ends, through one of which the foot is projected, while the other affords exit for the respiratory tubes. They are remarkable for their power of boring and burrowing, so as to form for themselves a habitat. The razor-shell (*solen*) can thus sink a way for itself into the sand with surprising rapidity. Some species of the genus *pholas* are equally noted for their power of boring into wood. Fixing themselves by the foot, they cause their shell to revolve, and thus with its edge cut a way in, the wearing of the instrument being constantly replaced by a fresh formation. They thus serve a useful purpose in destroying waste timber floating in the ocean; but when they attack ships, or wooden sea-works, the mischief which they do is incalculable.

CLASS GASTEROPODA.

60. This is an extensive class of mollusks, and perhaps the most typical of their province, since they have its general characteristics, of a well-developed nutritive system and sluggishness of habits, in the highest perfection. They derive their name Gasteropoda (γαστήρ, the belly, ποὺς, a foot) from their organ of locomotion, which is a muscular disk projecting from the abdomen, and capable of progress by alternate dilatations and contractions. In the more perfect forms, there is a distinct head, with the rudiments of eyes, which generally appear as a couple of black specks, either at the tips of the longest pair of tentacula (what in the snail are called its *horns*), or at their base. Most of the Gasteropoda are marine; but some dwell in fresh water, and a considerable number, unlike the mollusca in general, are inhabitants of the land, though usually fond of shady and moist situations. Excepting in a few species, the Gasteropoda are provided with shells. The shell is, in all except a few, of one piece (*univalve*); besides which, the animal has, in some instances, a small *operculum*, or lid, of calcareous or horny substance, which it draws down upon the mouth of its shell, so as to close itself in. The simplest form of shell is where it is composed of a low cone, without any spiral: such is the case in the limpet. In an allied genus, the *Pileopsis*, we find the point prolonged, and somewhat rolled upon itself; and by graduated links of this kind, we are brought to the regular spiral of the snail. That spiral winds round a kind of central pillar, the *columella*, ascending in a direction from left to right, and sometimes prolonged in a lengthy canal, by which the animal may communicate with the circumambient fluid without protruding its head from the shell.

61. Cuvier has arranged the Gasteropoda in nine orders, according to their organs of respiration.

62. ORDER CYCLOBRANCHIATA (κύκλος, a circle, and βράγχια, gills).—In these gasteropods the gills consist of little tufts or pyramids, attached in a circular arrangement to the inner surface of the margin of the mantle.

63. The Limpet family (*Patellidæ*).—Among these we find the power of locomotion at its lowest ebb, for they seldom remove far from the spot on which they were produced, and many of them, from the shape of the shell corresponding to the surface of the rock, appear never to have left it. The Common Limpet (*Patella Vulgaris*) is universally distributed around

our coasts. It subsists on sea-weeds of different kinds, living on the surface of rocks and stones between tide-marks. It



Limpet.

is sometimes used for food, though much too tough to become a delicacy.

64. The Chiton family, *Chitonidae* (χιτών, a garment), are characterised by a series of testaceous symmetrical plates, implanted in the back part of the mantle. Guilding says, these animals live on rocks and stones of the sea-coast, and are distributed nearly over the whole globe. Many species are constantly under water, while others ascend above high-water-mark, spending the day exposed to the hottest sun, or resting in spots occasionally moistened by the rude and restless surf. They seem to feed entirely by night. Though they remain stationary during the day, yet when disturbed they will often creep away with a slow and equal pace; sometimes sliding sideways, and creeping under rocks and stones for concealment. If accidentally reversed, they soon recover their position by violent contortions and undulations. They sometimes roll themselves up for defence.

65. ORDER SCUTIBRANCHIATA (*scutum*, a shield, and *branchiae*, gills) derive their name from having the gills covered with a shell in the form of a shield. The *Fissurellidae* (*fissus*, divided) have a shell shaped like that of a limpet, but with a fissure at the apex of the cone, and this opening is associated with a different form and arrangement of the breathing organs. The Ear-shell family, of which *Haliotes* is the type, are furnished with a handsome ear-shaped shell. They are inhabitants of the sea-shore, and live near and under rocks and stones. Their range is south of Britain as far as the Canaries. They are cooked for food; but a more important use of them is in making those mother-of-pearl ornaments, which constitute

so much of the beauty of works in papier-maché. Great quantities of Haliotes are brought to Birmingham for this purpose.

66. ORDER TUBULIBRANCHIATA (*tubulus*, a small tube, and *branchiæ*, gills) are so called from having long tubular snake-like shells, more or less irregular, in which the branchiæ or gills are lodged. These animals are permanently attached to other bodies, and have no power of shifting their station. In the genus *Magilus*, the young animal takes up its station in a hollow part of the madreporæ, and increases its shell in length as the madreporæ increases around it; keeping the aperture even with the outer surface of the coral, and thus securing free admission to the water.

67. ORDER PECTINIBRANCHIATA (*pecten*, a comb, and *branchiæ*, gills).—This is the most extensive order of the class, since it includes almost all the spiral univalve shells, as well as several which are merely conical. The order is thus characterised by Cuvier: the branchiæ, composed of numerous leaflets or fringes, ranged parallel, like the teeth of a comb, are affixed in two or three lines, according to the genera, to the floor of the respiratory cavity which occupies the last whorl of the shell, and which communicates outwards by a wide aperture between the margin of the cloak and the body. They have two feelers, and two eyes, raised sometimes on pedicles, with a mouth in the form of a proboscis, more or less lengthened. Under this order, the species of which are mostly carnivorous, are placed eight Families.

68. The Trochus family, *Trochidae* (τροχίς, a whorl or top), are so called from the pyramidal shape of their shell, which resembles a top. The whorl for the body is flattened, and the aperture is closed by a horny operculum, or some analogous part. The species are all marine. Some of our most elegant British univalves, and many of the most ornamental exotic shells, belong to this family. They are remarkable for boring with their proboscis into the shells of other mollusks. The buckie is perhaps the best known example.

69. The Marine Snail family (*Turbinida*) are characterised by having a shell of a regular turbinated form, generally much elongated, and a mouth entirely circular. With respect to their habits, it would appear that they frequent submarine banks covered with sea-weed, and are all vegetable feeders. A few are natives of fresh waters, and a limited number respire air. They are found in great abundance in the Indian seas, and are used as food, many being of large size. The winkle is a form of the family with which all are familiar. Another genus, the *Scalaria*, is remarkable for the beautiful and striking

form of its shell, one example of which has been valued at a hundred pounds.



Scalaria Preciosa, or Wentletrap.

70. The family *Capuloidæ* have a shell with an expanded opening, and but slightly turbinated, without operculum, notch, or a siphon. They do not appear to remove from the spot to which they are first attached, a cavity more or less deep being formed in the surface to which they adhere, either by the chemical agency of some solvent fluid, or by the long-continued operation of currents of water.

71. The Volute family, *Volutidæ* (*voluta*, a spiral wreath), form an extensive and interesting group, having beautiful shells, but all of them decidedly carnivorous. In the majority the eyes are sessile, placed at the base of two short tentacula; and the mouth is of a trunk form, and extensile; while the foot in the typical species is of enormous size. They are almost confined to warm latitudes.

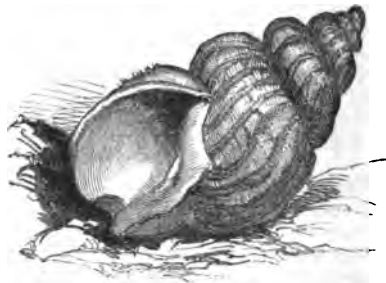


Money Cowry.

72. The Cowry family (*Cypræidæ*).—From the polish of their surface, and the beauty of their markings, the shells of

the Cowries are in considerable request as mantle-piece ornaments, and have been in demand in most countries from time immemorial. The shell of one species of Cowry, *C. Moneta*, is commonly used by the natives of certain parts of Africa, and other semi-barbarous regions, as money. It is yellow, or white with a yellow ring, the margin and base being tubicular.

73. The Whelk family (*Buccinidæ*) comprehends all the shells



Buccinum Undatum.

which have no fold at the columella or lip, but a notch or a short inflected canal towards the left. The mollusk is of a spiral form, with the foot shorter than the shell. The head is furnished with two tentacles, and the mouth is armed with a proboscis. The common whelk abounds everywhere on our coasts, where it creeps about in search of prey, boring holes with its trunk through the shells of other mollusks, and sucking their juices. This species is eaten, but is coarse and indigestible.

74. The Spindle Shell family, *Muricidæ* (*murex*, the purple-fish), have a univalve spiral shell, with a small oval aperture, ending in a straight or slightly ascending canal. The splendid shell of the *M. Regius*, which is found along the western shores of South America, is one of the ornaments of the cabinet of the conchologist. The Muricidæ, together with the Buccinidæ, appear to be destined to keep in



Murex Tenuispina.

check the superfluous numbers of the bivalve mollusks and herbivorous gasteropods, by drilling their shells and draining their juices.

75. In the *Strombidæ*, the aperture of the shell is much dilated; the lips expanding, and extended into a groove leaning to the left. The *Strombidæ* are carnivorous in their habits, and are tenants of the seas of hot latitudes. The number of the species is considerable, and many attain to enormous dimensions. In several of them, pearls have occasionally been discovered.

76. The *Conidæ* form an extra genus or family, comprising many species, one of which, the common *Cone*, possesses a shell of uncommon elegance of form, and rendered additionally attractive by fine colouring.



The Cone.

77. ORDER HETEROPODA (*ἑτερος*, different, other, and *πούς*, a foot).

—This order comprehends those gasteropods which have the foot compressed, and in the form of a thin vertical fin. The branchiæ, which are plum-like, are situated on the hinder part of the back, directed forwards; and immediately behind them are the heart, the liver, and viscera. The body is gelatinous and transparent, with a muscular covering, elongated, and generally terminating in a compressed tail.

78. The genus *Carinariæ* (*carina*, a keel) are characterised by having the heart, the liver, and the gills protruding from the body, and incased in an extremely fragile and beautiful shell, the convexity of which is terminated by a single keel, whilst the tail is furnished with a sort of fin, which performs the part of a rudder.

79. The genus *Piroles* in general resemble the *Carinariæ*; but no shell has been observed. Their snout is prolonged into a recurved proboscis. They are common in the seas of the warm or temperate latitudes.

80. ORDER TECTIBRANCHIATA (*tectus*, concealed, and *branchiæ*, gills) comprehends those species in which the gills are folliculated on the right side or on the back. These animals are generally covered by a small bubble-shaped shell, concealed in the folds of the mantle. They are all marine, living chiefly on the shore, or on floating sea-weed. They may be further described as thick, fleshy, soft mollusks, generally possessing a distinct head, furnished with a pair of ear-shaped tentacula,

and with the mantle usually dilated into two lobes resembling fins, with which they can both swim and crawl. Many of the



Bursatella Leachii.

species are very large, and when taken out of the water appear like great oval masses of flesh. This order consists of two Families. The *Bullidæ* (*bulla*, a bubble) have the shell so perfect as sometimes to be capable of receiving the greater part of the animal, and it is always more or less convolute. The *Aplysianidæ* possess a mere rudimentary shell, resembling one-half of a bivalve. The upper tentacula probably suggested the idea of the ears of the hare; whence the common name of sea-hares given to these animals by the fishermen in most countries.

81. ORDER INFEROBRANCHIATA (*inferus*, lower, and *branchia*, gills) have the gills situated beneath the extended margin of the mantle, and consisting of two long series of leaf-shaped organs. They are incapable of swimming, and are confined to the shore. Their food consists of sea-weed. This order in the system of Cuvier comprehends only two genera—*Phyllidia* and *Diphlidia*—of which little is known.

82. ORDER NUDIBRANCHIATA (*nudus*, naked, and *branchia*, gills).—This order of gasteropods, which might be denominated sea-slugs, have the gills exposed on some part of the back, in the form of a rosette, so as exactly to resemble a bunch of vine leaves whose stalks form a common centre. It includes all the naked marine gasteropods, as Triton, Doris, and Tethys. They are generally ornamented with beautiful colours. Besides moving about like other gasteropods, by means of their foot, or concave under side of their belly, in

the depths of the ocean, some species—as the Tritons and Dories—have the power of swimming and crawling on the surface of the sea, with the foot uppermost. In swimming, they are propelled both by their branchiæ and the sides of their body, which act in the manner of fins.

83. ORDER PULMONATA (*pulmo*, a lung) Snails and Slugs, the most advanced of gasteropods, are furnished, instead of branchiæ, with a vascular net-work of pulmonary vessels, fitting them to breathe the atmospheric air. Most of them, accordingly, are land-animals; and those which are aquatic—living chiefly in fresh waters and brackish pools—are obliged, like the whales and seals, to come occasionally to the surface to breathe. All the breathing gasteropods feed chiefly on vegetables, and many of them exclusively so; but some are extremely voracious, and will devour almost any organised matter that falls in their way. They are diffused through all climates, particular species being restricted to each.

84. The aquatic pulmonata have only two tentacula. The family *Lymnæidæ* (Pool Snails) reside in stagnant waters, feeding upon plants and seeds, and having, for the digestion of the latter kind of food, a very muscular gizzard. Another noted family—*Planorbis* (Marsh Snails)—are distinguished by having the coil of their shells upon one plane. They are very common in England.

85. The *Lymnæa* is remarkable from its connection with a very curious phenomenon in the reproduction of entozoa, lately brought to light. The *Cercaria* is a small parasitic animal, a little like a tadpole in form, which, by means of a sucker, attaches itself to the body of the *Lymnæa*, on which it lives. By and by, while in this condition, it is transformed into a kind of worm, with a double sucker, and is recognised as the *Distoma*. We thus become aware that the *cercaria* is a transient or immature form of the *distoma*, as the caterpillar is of the insect. The question arises, What is the origin of the *cercaria*? It appears that, at a certain season of the year, the viscera of the *Lymnæa* contain a quantity of little worms, of elongated form, with a well-marked head, and in each of which are clearly to be observed a number of young *cercariæ*. When these have reached a certain size, they leave the body of the worm, and escape also from that of the *Lymnæa*, to fasten upon its exterior, there to pass on to the subsequent condition of the *distoma*. Naturalists call the worm the *nurse* of the *cercaria*. They further observe these nurses to be the produce of another intestinal worm in the *Lymnæa*, one longer and more slender, and to which they give the name of the *grand-nurse*. Supposing these grand-nurses to be the immediate progeny of the

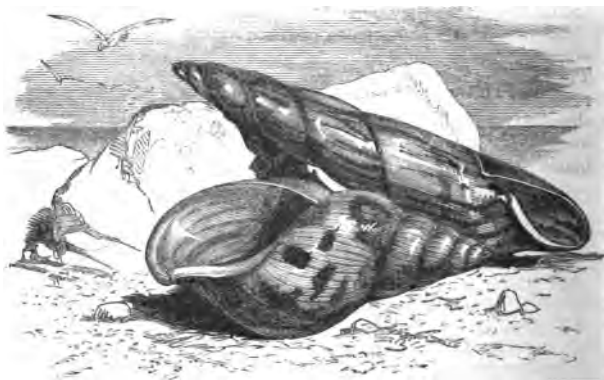
distoma, as is probable, we have thus a quadruple series of generations, each presenting an animal more or less peculiar in its form.

86. The family of *Helicinæ* (Land Snails) are among the most familiarly known of all animals. They possess a shell, generally much thinner than that of the marine gasteropods, and into which they withdraw themselves under apprehension



Snail.

of danger or when at rest. They feed exclusively on vegetables, biting off pieces of the leaves by means of a horny plate attached to the upper lip; and their destructiveness in gardens is well



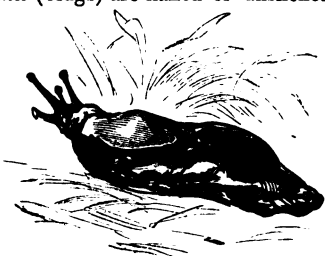
Achatina Zebra.—*Achatina Virginea*.

known. The common Garden Snail of this country (*Helix Hortensis*) is much exceeded in bulk by the Great Vine Snail

(*H. Pomatia*) of France and Italy, which has also been occasionally found in Britain. More striking examples of the family are to be found in tropical climates, where some species of the genus *Bulimus* attain to so great a size, that their eggs are as large as a pigeon's. In some species, the direction of the coils of the shell is opposite to what it is in other spiral shells; such are said to be *reversed*. Another large snail of tropical climates is the *Achatina*, which feeds on trees and shrubs, and is generally distinguished by the beautiful colours of its shell.

87. The family of *Limacinæ* (Slugs) are naked or unshelled

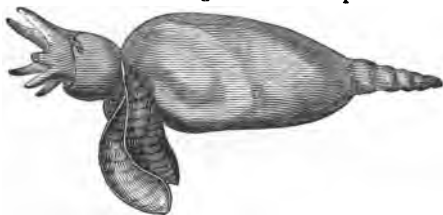
snails, noted as the pests of gardens on account of their great destructiveness amongst vegetables. The slug has a prominent head, with four tentacula, and at the end of the longer pair the eyes are situated. These tentacula (usually called the *horns*) can be drawn in by a process resembling the inversion of the finger of a glove.



Slug.

On the back there is a kind of shield or disk, which sometimes encloses a small shell, and under which is placed the pulmonary sac or breathing apparatus.

88. PTEROPODA are a remarkable group of marine mollusca, which Agassiz places in connection with the Gasteropoda. They are small animals, generally destitute of shells, and provided with wing-like appendages, by which they move through the water; hence their name (*πτερόν*, a wing; and *πούς*, a foot). The body is symmetrical, and hence the better adapted for swimming. The Pteropods are found in

*Clio Borealis*.

enormous multitudes; one of them, the *Clio Borealis*, which abounds both in the Arctic and Antarctic Seas, forms a

very important article of food to the whale, which swallows thousands at a mouthful. This little animal is itself eminently carnivorous, and well fitted to seize the minute animals which form its prey. Its six tentacula are provided each with about 3000 invisible filaments, each of which is furnished with about twenty *suckers*; thus each clio is computed to possess 360,000 examples of that form of pneumatic apparatus, for the purpose of prehension or seizing—a complexity of structure considered as perhaps without example in the animal creation. When the prey is drawn to the mouth, it is there reduced by a series of sharp thorny teeth, set like those of a comb upon a pair of horny jaws; and it is then drawn into the gullet by the tongue, which is covered with regular rows of spiny hooklets, all directed backwards, and evidently intended to assist in the act of swallowing.

CLASS CEPHALOPODA.

89. The Cephalopoda are so named, from their having their limbs arranged in immediate connection with the head. These limbs, in some eight, in others ten in number, perform all the offices of feet, arms, and feelers, and in many genera they are used also as fins. The head, from the arrangement of the limbs, is in the centre, like that of the radiata. They are, nevertheless, the most highly organised of invertebrate animals, presenting rudiments of an internal skeleton, developed for the purpose of protecting a brain and lodging organs of sight, and, in most of the existing species, organs of hearing. They possess distinct hearts, for the systemic and pulmonary circulations, and highly complicated digestive, secretory, and respiratory organs. Their head is large and conspicuous. All the species are marine and carnivorous.

90. ORDER DIBRANCHIATA (*Δις*, twofold, and *Βράγχια*, gills). This order includes those species which have two gills, and are characterised by having three distinct hearts, an apparatus for secreting and emitting an inky fluid, and cephalic arms, never above ten in number, solid, and supporting suckers.

91. The most typical form of this order is the Cuttle-fish, *Sepiadae* (*σνρία*, a cuttle-fish). These animals have immense arms, which are also used as legs; by these they crawl with the greatest facility on the bottom of the sea, swim quickly in the water, and retain a forcible hold of the animals upon which they prey. Their eyes are large, and fully developed, like those of the vertebrate animals. In size, cuttle-fish far exceed all the testaceous mollusks, and may be termed the

giants of the Invertebrata. If the accounts of the old Indian voyagers be true, there are some of such enormous dimensions,



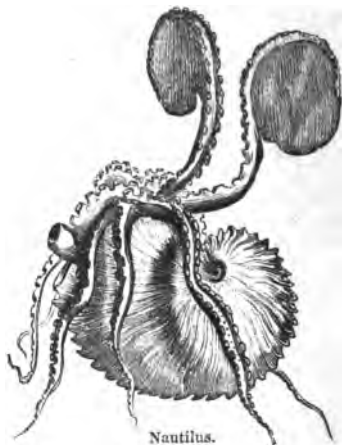
Cuttle-fish.

that they seize upon the divers, entangle them in the folds of their serpent-like arms, and finally devour them. These stories are greatly exaggerated; but it is well known that many have been caught of such a size, that two of them would be a good cart-load. The flesh of the cuttle-fish was highly prized by the ancients; and in many countries, though not in Britain, it is still used as an article of food. The common species forms the bait with which one-half of the cod-fish taken at Newfoundland is caught.

92. All the varieties of the Sepiæ yield a dark-coloured juice; and the typical species, *S. Officinalis*, is chiefly sought after for the profusion of fluid which it affords. This juice forms a beautiful brown colour, with a fine grain, and has given name to a species of drawing now extensively cultivated for landscapes and other branches of the fine arts. Sepic drawing was first practised at Rome nearly a century ago. From the rudiment of their calcareous shell, imbedded in the back of the mantle, the material called pounce is made—a powder used to prevent ink from spreading upon paper after erasures. The eggs of the cuttle-fish are attached together in clusters, and are commonly called *sea-grapes*.

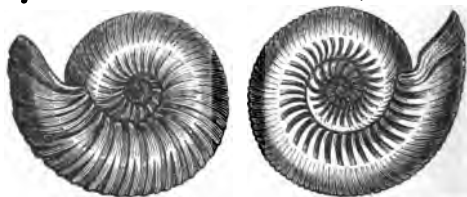
93. ORDER TETRABRANCHIATA (four-gilled) consists of only one family, *Nautilidæ* (*naūs*, a ship), of which the genus *Nautilus* is the type. They have a chambered cell, with simple *septa*, or divisions, perforated in the centre, concave towards the outlet of the shell, and with the last chamber the largest, and containing the body of the animal. It was long supposed that

the nautilus swam on the surface of the sea, raising two feet like masts, and extending a membrane between them which served as a sail, the other two feet being employed as oars; and that,



in the early ages of society, the art of navigation owed its origin to the expert management of this instinctive sailor.

94. The Cephalopodous mollusks bore a conspicuous part in the earliest ages of creation of which we have any record—what geologists term the Palæozoic period. In the absence of fish, they were the chief destructives, and some of them attained a size truly monstrous. Of their fossil-shells, the *Ammonite* is



a well-known example, having a spiral coil; this, though supposed to have been an internal shell, occasionally measures four feet in diameter. Another well-known fossil relic of this class is the *Belemnite*, which is believed to have been likewise an internal structure, forming the rudiment of a vertebral column.

PROVINCE THIRD.—ARTICULATA.

95. THE *Articulata* (*articulus*, small joint), or Jointed Animals, rank much on a general level with the Mollusca; but being allowed to have a superiority in the nobler parts of the animal structure, they may be arranged as third, instead of second, in the ascending scale.

96. They are characterised by having their bodies in segments, and by the greater number of them possessing an external skeleton or case, adapted to the segments of their bodies, and to which muscles are attached. While the vegetative portion of the frame—namely, the organs of nutrition and circulation—are more largely developed in the Mollusca, the organs of the animal powers, the nervous apparatus, and arrangements for locomotion, are more largely seen in the Articulata. They have a symmetrical double nervous cord extending along the whole body, studded with knots or *ganglia*, from which proceed branches to the various segments, and terminating anteriorly in a kind of brain, in the form of a ring surrounding the gullet. The Articulata are consequently distinguished by comparative activity of movement, one large class—the Insects—possessing generally a power of rapid flight in the air. This department of the Animal Kingdom is also noted for the immense variety of its forms, some of its orders presenting many thousands of distinct species. Some are directly beneficial to mankind; but a large proportion chiefly attract attention by their great powers of tormenting, and the injury which they can inflict. These noxious qualities, however, are chiefly experienced in warm climates.

97. Professor Agassiz considers the Articulata as capable of being arranged in three Classes—namely, Worms (*Annellata*), Crustaceans, and Insects. The Arachnida, however, which Agassiz would class with Insects, are usually placed separately.

CLASS ANNELLATA.

98. This is decidedly the lowest form of Articulata. The body consists of a long series of segments, without any hard casing, and without any limbs. The first segment, forming the head, usually differs little from the rest, except by the presence of the mouth and the principal organs of sense. The blood is

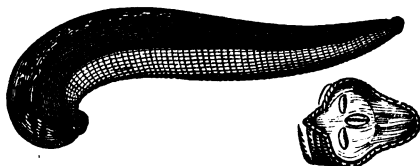
coloured; but though often of a reddish hue, it is found, on microscopic examination, to be differently constituted from the red blood of the vertebrated animals. The Annelata are divided into three Orders, distinguished by their respiratory organs.

99. ORDER ABRANCHIA (α , priv., and $\beta\epsilon\acute{\alpha}\gamma\chi\iota\alpha$, gills), are so called because they have none of the ordinary external organs of respiration, but breathe from the surface of the skin, or, as some suppose, by interior cavities. The greatest part of the animals of this order live at the bottom of the sea, or in fresh water; but a few—like the earthworm—reside in humid ground. The order is divided into two Families—*Lumbricinidæ* (Worms), and *Hirudinidæ* (Leeches).

100. The Worm family, comprehending the aquatic genus Naiades, and the Earthworms, are remarkable as provided with silky bristles. The common earthworms are of marked importance in the economy of nature. Besides affording food to a vast number of the feathered tribe and some quadrupeds, they are of great service to the agriculturist. They loosen the earth, rendering it pervious to air and water, as well as to the fine fibres of the roots of plants, and are most active and powerful agents in adding to the depth of the soil. For example, it is a fact well known, that lime or marl put on pasture-land is in a few years buried to the depth of some inches below the turf. This is not, as many suppose, because the particles have worked themselves down, but is owing to the digestive process by which the common earthworms are supported. They subsist on decayed animal and vegetable matter, which they find at a considerable distance below the surface of the ground; and after having separated the serviceable portion, they come to the mouth of their holes, and eject the remainder in little intestine-shaped heaps. In one instance it was ascertained, that in the course of eighty years they had covered a field with a bed of earth thirteen inches in thickness.

101. The Leech family (*Hirudinidæ*) have an oblong body, sometimes depressed and wrinkled transversely; both ends are adapted to fix on bodies by a kind of sucker, by means of which these animals move when out of the water. When in their native element, they swim with facility. One species, the medicinal leech (*Hirudo Medicinalis*), so useful in local blood-letting, is well known. Its mouth contains three rows, each armed with a double range of very fine sharp-set teeth, which enable it to pierce the skin without inflicting a dangerous wound. The trade in leeches is carried on to a great extent. Leech-dealers drive horses and cows into the ponds, that the leeches, by sucking their blood, may fatten and propagate more

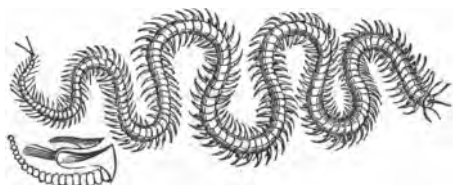
abundantly. In the spring of the year, children are employed to catch them with the hand, and grown persons wade into the



Leech, with the anterior sucker and teeth enlarged.

shallow waters, and catch them as they adhere to their naked legs. In summer, the leeches retire into deep water, and are taken by nets made of twigs and rushes. They are very common in the south of France.

102. ORDER DORSIBRANCHIATA (*dorsum*, the back, and *branchiæ*, gills) have their gills or breathing organs projecting from the middle parts of the back or sides of the body, where they assume the form of little ramified branches, tufts, plates, or tubercles. The greater number of the species of this order live in the mud, or freely swim in the ocean; but a few, like the next order, inhabit tubes. One of the most interesting families of this order is the *Nereidæ*, or Sea-centipedes, many specimens of which occur on our own coasts.



Syllis Monilaris, a sea-centipede, with an enlarged representation of one of its appendages.

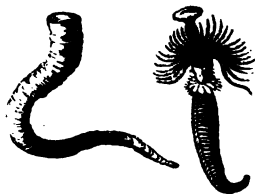
Some of the Nereids exhibit a singular peculiarity in their mode of propagation. The hinder part of the body, being gradually transformed into an additional animal, is cast off by spontaneous division.

103. A species of the Dorsibranchiates which inhabits the sand (*Lumbricus Marinus*) is very abundant on our coasts, and is dug up for bait by fishermen. It is nearly a foot in length, of a reddish colour, and ejects, when touched, a quantity of yellow fluid. It has three pair of gills.

104. ORDER TUBICOLÆ (*tubus*, a tube, and *colo*, I inhabit)

are so called because they generally occupy tubular sheaths, consisting either of calcareous matter, secreted from their own bodies, or of particles of clay, or of very fine gravel, agglutinated together to serve as a habitation. They are further characterised by their branchiæ or gills being attached to the head or anterior portion of the body. These are in the form of a plume of feathers, and generally vividly coloured.

105. The most common Tubicules on our coast are those which belong to the genus *Serpula*. They are found incrusting the surface of stones and shells which have been dredged up from the bottom of the sea. Professor Jones remarks: 'If, while the contained animals are alive, they be placed in a vessel of sea-water, few spectacles are more pleasing than that which they exhibit. The mouth of the tube is first seen to open by the raising of an exquisitely constructed door, and then the creature cautiously protrudes the anterior part of its body, spreading out at the same time two gorgeous fan-like expansions of a rich scarlet or purple colour, which float elegantly in the surrounding water, and serve as branchial or breathing organs.'



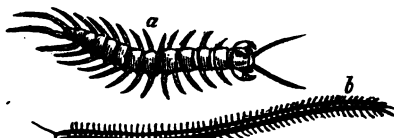
Serpula Contortuplicata, taken out of its tube.

106. In near connection with the Annelata may be placed the MYRIAPODA, which many naturalists regard as a separate class. They might be considered as worms, provided with a stiffened integument and with slender legs, and fitted to breathe the air with regularity and energy. The common *Centipede* is a familiarly known representative of the group.

107. The ORDER IULIDÆ, or Millipedes, make the least advance from the annellate character. In the *Iulus terrestris*, or Gallyworm, we find a long cylindrical body, of about fifty hard rings, each giving origin to two pair of small legs. There is a distinct head, with eyes, *antennæ* or feelers, and a pair of stout horny jaws, furnished with sharp-toothed edges for cutting the vegetable food on which the animal mainly lives.

108. The ORDER SCOLOPENDRIDÆ, or Centipedes, have fewer rings, and may therefore be considered as superior to the Iulidæ. They are eminently carnivorous, and, in order to seize the insects on which they prey, possess, in addition to the horny jaws of the other order, a pair of strong sharp claws, formed by an enlargement of the second pair of legs, which are

perforated at the tip with a minute aperture, through which a venomous fluid is probably instilled into the wounds made by



a, *Lithobius Forficatus*; b, *Geophilus Longicornis*.

them. The centipedes live under stones and in chinks of timber, and often lie in wait for their prey in the ripe fruit to which insects are so apt to resort. One British species, the *Geophilus electricus*, is remarkable for emitting a phosphorescent light, nearly as bright as that of the glowworm.

CLASS CRUSTACEA.

109. The Crustacea, so called from the hard calcareous case in which they are enveloped, are characterised by a branchial respiration and a dorsal ventricle or heart. From comparative inertness, and large development of the feeding-system, they resemble the Mollusca more than do any of the other articulate classes. They are chiefly marine, and of carnivorous habits. As in insects, the body comprises a head, thorax, and abdomen, which, however, are in some combined in one piece. In the head are compound eyes, a mouth with *mandibles*, frequently furnished with *palpi* or feeling-organs, and *maxillæ* in some instances prolonged into a pair of feet. From the thorax proceed four pair of true legs, and one pair of claws, which sometimes reach a large size. The abdomen is also in some families furnished with feet, giving the animal a resemblance to the myriapod. As the investing shell does not increase with their growth, they throw it off periodically, even to the hard facets on the exterior of the eyes, and thereafter a new shell grows upon the soft surface. Cuvier divides this class into two great sections—the MALACOSTRACA (*μαλακίς*, soft, and *ὄστρακον*, a shell, the term soft being applied in a comparative sense), including all the true calcareous-shelled animals of the class; and ENTOMOSTRACA (*ἰντομος*, incised), embracing those which have the integuments of the body of slender consistence, and corneous or horny rather than calcareous.

110. The *Malacostraca* are divided into five Orders.

111. ORDER DECAPODA (*δέκα*, ten, and *πούς*, a foot), a

name applied by Cuvier to this order, because they have ten thoracic feet. Most of the species are useful as food.

112. The family of *Brachyura* (βραχύς, short, and οὐρά, a tail), or Crabs, have the tail or post-abdomen short and folded beneath the trunk. The Edible Crab (*Cancer pagurus*) is the type. It has the carapace, or shield, which covers the head and thorax, broad and arched for a considerable distance along the sides, each side having nine festoons, and the middle in front armed with three short teeth. The structure of the abdomen is very remarkable, forming a sort of leaf, disproportionately small, and which folds back upon the under side of the thorax. The edible crab is of common occurrence on the rocky coasts of England and France. It is captured either by nets, or by sinking baskets baited with decaying animal matter to a considerable depth. In summer, at low tide, they are found in holes of rocks in pairs, male and female; and if the male be taken



Crab.

away, another will be found in the hole at the next recess of tide. By knowing this fact, an experienced fisherman may twice a day take with little work a vast number, after having discovered their haunts. In the winter, they are supposed to burrow in the sand, or to retire to the deeper part of the ocean.

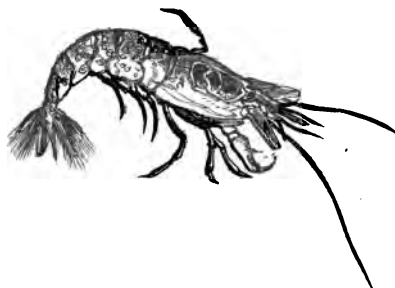
113. The Land Crabs—called also Violet Crabs and White Crabs, from their colour—are natives of the West Indian Islands and South America. The history of these creatures presents some singular phenomena. Their usual habitation is in the mountains, away from the sea and water, where they reside within cavities or burrows of the earth and rocks, or in hollow trees. They feed variously; and it is known that they will prey as freely upon putrid carcasses, disputing their possession with the vulture, as upon fruits and vegetables; and yet they are esteemed and used as delicate and choice articles of food. Their instinct prompts them, at the period of oviposition, to seek the shores of the ocean, and therein to deposit their eggs; and this migration they execute in such multitudes, that the land is literally covered with them; and their progress is as direct and destructive as a stream of lava. Having arrived on the coast, they bathe themselves, and then deposit their eggs. This accomplished, they again seek their former habitations, but of course in a considerably exhausted state; and

they therefore frequently halt to repose on their journey. It is alleged that, under the apprehension of danger, they will try to produce intimidation by the clatter of their claws. Having regained their domicile, they undergo their moult, which is a critical period in their lives. They are then soft and sickly, their integument resembling wet parchment. To shelter themselves from external injury, they shut themselves in their burrows; and it is now that their flesh is most esteemed. Their eggs, meantime, being cast upon the sand, are speedily hatched by a combination of heat and moisture, and the young hasten to the adjoining fields, where they gradually acquire the strength and size requisite to enable them to undertake their migration to the haunts of their parents. They are chiefly nocturnal animals, migrating and preying at night. They possess a cavity in the vicinity of the gills, which serves as a reservoir for the water requisite to keep these organs constantly moistened; but their vitality is soon suspended by immersion in water.

114. The family of *Macrura* (*μακρος*, long, and *ουρα*, a tail) includes all those ten-footed crustaceans which have the tail or post-abdomen at least as long as the body, and exposed and bent downwards towards the posterior extremity, and always composed of seven segments; and they have at the end of the tail, on each side,



Cray-fish.



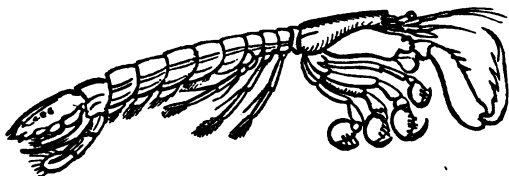
Shrimp.

appendages ordinarily forming an instrument for swimming. The *Macrura* may be considered as forming a single genus, *Astacus*. The species are commonly known by the names of Lobsters, Cray-fish, Prawns, and Shrimps.

115. The family of Hermit Crabs

(*Anomoura*) has the abdomen prolonged, but destitute of a shell, so that the tail is soft. They are remarkable for their habit of living in the deserted shells of mollusca, exchanging a less for a larger as they increase in size, and fixing themselves to their strange habitation by peculiar processes which seem developed for the purpose. 'The manœuvres of some of our native species, when they have outgrown their habitation, are quite ludicrous. Crawling slowly along the line of empty shells left by the last wave, and unwilling to part with their now incommensurable domicile until another is obtained, they carefully examine one by one the shells which lie in their way, slipping their tails out of the old house into the new one, and again betaking themselves to the old one if this should not suit. In this manner, they proceed till they have found a habitation to their liking.' They feed upon dead fish, and all kinds of garbage, thrown upon the shore; and when alarmed, they draw themselves closely into the shell, and close the aperture by placing their claws over the entrance.

116. ORDER STOMAPODA (*στόμα*, a mouth, and *ποῖς*, a foot), commonly called *Sea Mantes*, comprehends crustaceans



Squilla Mantis.

possessing maxillary feet formed like the first of the thoracic feet. Their gills are naked, and adhere to the five pair of appendages attached beneath the abdomen or tail. These appendages are used in swimming—in other words, they are fin feet. The habits of the Stomapoda are not well known. It is, however, beyond a doubt, that those species with powerful claws use them for the purpose of seizing their prey, in the same manner as those Orthoptera which are named *Mantes*; and it is on account of this conformity that these Stomapoda have received the name of *Sea Mantes*. The *Cancer Mantis* is the type of the order; it is about seven inches in length. Its great claws have at the base three movable spines, and the terminal joint has six long and very sharp spines, of which the terminal is the strongest. This species is common in the Mediterranean.

117. ORDER AMPHIPODA (*ἀμφίς*, on both sides, and *ποῖς*,

a foot—feet diversely conformed) are small animals, mostly marine, which sometimes are found in brooks and fountains. The majority swim and leap with agility, and always on their sides. The species best known in Britain is the Sandhopper, which burrows in the sand, and seldom enters the water. It feeds on mollusks and fish.

118. ORDER LÆMODIPODA (λαίμοδος, the throat, and πούς, a foot.) These crustaceans have the head confluent with the first segment of the thorax, and supporting the four anterior feet. The posterior extremity of their body exhibits no distinct branchiæ. The Læmodipods are of *small size, all marine animals*, and parasitical; many of them live upon cetacea. The fishermen call them *whale lice*. Sometimes these creatures are so abundant on the whales, that the individuals they infest may be easily recognised at a considerable distance by the white colour these parasites impart to them. When they have been removed, the surface of the body of the whale is found to be deprived of its outer skin.



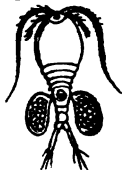
Cyamus Balaenarum.

119. ORDER ISOPODA (ἴσος, equal, and πούς, a foot) comprehends such crustaceans as have the legs all alike, and adapted only for locomotion and grasping. Their bodies are broad and depressed, and they do not leap. The greatest number of the species are aquatic. Those which are terrestrial have likewise need, as is the case with other crustaceans living out of the water, of a certain degree of atmospheric humidity, in order to keep their branchiæ in a state fitted for the act of respiration. Among the Isopods, we find the *Oniscidae*, or Woodlice, St Anthony's Hogs, &c. They frequent dark and concealed places, such as cellars, caves, chinks in walls, and hollows under stones. They feed upon decaying vegetable and animal matter, and only come forth from their retreat in wet and moist weather. They crawl but slowly, at least when not alarmed.

120. The *Entomostraca* are divided into two Orders. The crustaceans of this section are in general so small, that the details of their structure can only be examined by the microscope. The legs, except in a few, are only fitted for swimming, and are variable in their number; some species have only six, others from twenty to forty-two, or even more than a hundred. They mostly inhabit fresh water. The Entomostracans are divided into two Orders—*Branchiopoda* and *Pecilopoda*.

121. ORDER BRANCHIOPODA are so named because the locomotive extremities fulfil the functions of gills. The majority of the animals of this order swim with the back

downwards, darting about with great agility, and moving backwards and forwards with equal ease. Many exhibit only one eye, as in the family *Monoculidae* (μόνος, one, and *oculus*, an eye), or Cyclopes. The type of this family is the *Cyclops Quadricornis*. It is very common in the ponds and ditches of this country. It has all the antennæ single, and not divided; the body oval; and the tail six-jointed. It is about one-fifth of an inch in length. The female has an oval sac on each side of the tail, in which the eggs are carried. By calculation, it appears that, at the end of one year, a female which gives birth to forty young at a time, may become the progenitor of 4,442,189,120 young. One species of this family is found in such inconceivable profusion beyond 42° of south latitude in the Pacific and Atlantic Oceans, that it gives the surface of the sea a red tint, and serves as food for whales.



Cyclops Vulgaris, magnified.

122. ORDER PÆCILOPODA (πεκίλος, various, and πούς, a foot) includes such Entomostracous Crustaceans as have feet of different forms and uses; the anterior, of indeterminate number, serving either for walking or seizing, and the posterior feet branchial, and fitted for swimming. They live chiefly as parasites upon aquatic animals, and mostly on fishes. This order may be divided into two families—*Hyphosura* and *Siphonostoma*.

123. The family of *Hyphosura* (web-tailed) are remarkable for having the shield terminated by a very powerful horny, movable spike, like a sword. They are of a large size, sometimes measuring two feet in length. They compose the genus *Limulus* (*limus*, mud), commonly known by the name of King Crabs, or Crabs of the Moluccas, in the neighbourhood of which they are very abundant. They chiefly inhabit tropical seas, and are found near the shore. In China, their eggs are eaten, but their flesh is given to pigs. Savages make use of the horny style at the extremity of the body for arrow-points and spear-heads.



Limulus Polyphemus.

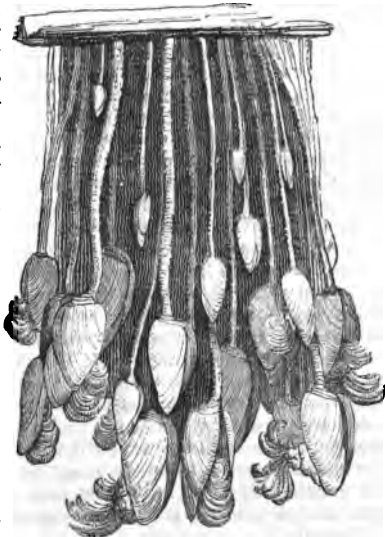
124. The family *Siphonostoma* are so named from their siphon-shaped mouth, which is fitted for suction. Their shell is very slender, and of a single piece. They are all parasites, and are known by the name of *fish-lice*. They are found upon perch, pike, and carp. They also occur occasionally upon the cod; but they are never seen within the gill covers.

125. The CIRRHPODA (*cirrus*, a tendril, and πούς, a foot) are a family of Crustacea, of such peculiar and dubious form that

till lately they were classed as mollusks. They are best known by the appellation of Barnacles. Entirely marine, they, in their mature state, attach themselves to rocks, pieces of floating timber, or the bottoms of ships, and even to the backs of other animals, where they find a diminutive prey. The remarkable feature of their external appearance, which has created such doubts respecting their proper place in the Animal Kingdom, is a many-valved shell, two of the pieces of which greatly resemble those of the common mussel.

126. In the early stage of their existence, the Cirrhopods are free and locomotive, but at a certain period they choose their resting-place; a shelly crustaceous covering is secreted, and they are fixed, either by their shell or by a flexible peduncle, immovable at the base. It is amusing to watch their operations. This can easily be done by taking a piece of floating timber to which they are attached, and placing it in a vessel of water. They will soon be seen protruding their fringed feet, consisting of a testaceous tube, the aperture of which is more or less closed by two or four valves, which they use as arms, and ever and anon instantly withdrawing them into their shelly coverings as soon as they have captured their minute prey. This class is divided into two Orders — Barnacles (*Lepadites*), and Acorn-shells (*Balanites*).

127. The LEPADITES comprise the Cirrhopods which are elevated upon a fleshy flexible contractile stem, attached by its base to some solid body, and supporting at its extremity the principal parts of the animal, enclosed by a multi-valve shell or leather-like case. The species most widely spread in our seas is *Lepas anatifera*—literally, the goose-producing; a name which



Group of *Anatifera*, attached to a ship's bottom.

records one of the most remarkable delusions of the early observers of animated nature. It was fully believed in the sixteenth and seventeenth centuries, and set forth on many trustworthy testimonies, that a particular species of goose originated in these shell-fish, and this bird was on that account called the *Barnacle Goose*. The authors of this fable must have been misled by some slight and accidental resemblances.

128. ORDER BALANITES, or *Acorn-shells*.—In these the *shell* is attached to some solid body. In other respects they differ little from the former order. The rocks, shells, and piers of all our coasts are in a manner covered with a species of the *Lepas balanus*. Others plant themselves on the skin of whales, and penetrate into their lard.

CLASS INSECTA.

129. The INSECTA, or Insects, are a class of such endless variety of forms, that zoology would be a great branch of human knowledge if it comprehended them alone. The insect may be described as an articulate animal, with a body of three parts—head, thorax, and abdomen—and three pair of legs; having a peculiar breathing-apparatus of tubes distributed through the body; and generally, but not in all instances, furnished with one or two pair of wings, by which it is enabled to spend a portion of its time in the air. It is also distinguished by undergoing metamorphoses, or changes of form, between its leaving the egg and attaining its adult condition. That is to say, it emerges from the egg into the *larva*, or caterpillar, with all the appearance of a simple worm; in which condition it feeds voraciously and grows rapidly. It then passes into the *pupa* or *chrysalis* state, in which it is cased up in a coriaceous or leather-like covering, like a mummy, and seems all but devoid of life. Finally, it emerges from this condition as the *imago* or perfect insect. There are, however, varieties in these conditions. The larvæ of some insects, for example, reside in tubes which they construct for themselves (the *caddis-worm*); some spin a thread from their bodies, and winding this into a kind of case or cocoon, spend their time therein till ready to come out as perfect insects (the *silk-worm*).

130. From the great variety of species in the Insecta, and the great fecundity which belongs to most of them, they form

a prominent and most important part of creation. 'To leap, to run, to walk, to bore into the ground or drive galleries through timber, to fly through the air, to gambol in the water, to dive and swim, are amongst the endowments of insects. Some build structures more wonderful than the Pyramids, while others construct habitations with mathematical accuracy, and have streets and palaces bearing no slight analogy to those of human communities. Some gleam with phosphorescent radiance, or flutter about painted in all the glories of the rainbow. They furnish us with silk, wax, honey, lac, cochineal, and gall-nuts. Some hold a most important place in the pharmacopœia, and most of them furnish food to the beasts of the earth and birds of the air, to the fish and reptile tribes, and to some of the more powerful of their own class.'

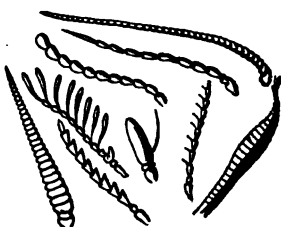
131. The larva always consists of twelve ring-like sections, exclusive of a head. These twelve sections are still to be traced in the perfect insect, three of them being comprised in the thorax and the remainder in the abdomen. From each of the three sections of the thorax proceeds a pair of legs, and the second and third usually give origin to a pair of wings each. It is remarkable that in the larva of the butterfly, so familiar to us as the cabbage-worm, there is the appearance of a pair of legs connected with each of the twelve sections; but only the three which subsequently constitute the thorax have real legs, the rest being mere tubercles or prominences serving the same purpose. In the accompanying sketch of the parts of the perfect insect, the three sections of the thorax (*t t t*) are represented apart, with the legs and wings attached to them.



Segments of Insect.

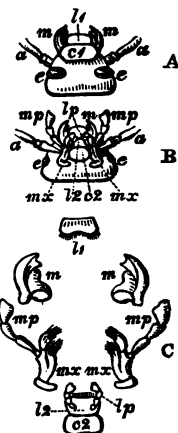
132. Insects in their perfect state are distinguished beyond all other animals by their powers of locomotion, and the perfection of their instinctive actions. Their senses appear to be acute. They have generally large eyes, formed by the union of a great number of small ones, presented in different directions, so as to secure a great range of vision. Organs of hearing and smell are believed to exist, though they have not been

satisfactorily made out. That there is a delicate sense of touch is not to be doubted, and from observations made on bees and ants, there is reason to believe that they communicate with each other by this sense. A prominent feature of the head of many insects is a pair of *antennæ*—jointed instruments of various forms—which are evidently used as exploratory organs; of a similar character and similar use are two pair of *palpi*, or feelers, attached to certain parts of the mouth.



Variouly formed Antennæ.

133. In one large group of insects, the mouth is furnished with an apparatus fitted for chewing and bruising the substances on which the animals are intended to feed. In the other great division of the class, there is a proboscis, or *haustellum*, for sucking up juices. The first kind of apparatus consists of six principal pieces, the chief being a pair of *mandibles* or cutting instruments, which work against each other, much like a pair of scissors, and sometimes end in hooks, more formidable, for the size of the animal, than the teeth of the tiger. Where, from the presence of a sucking-instrument, the mandibles are not required for eating, they are used variously as trowels, spades, pickaxes, saws, or knives, in the construction of habitations. Below the mandibles, there is a smaller pair of instruments of similar character, termed the *maxillæ*; and it is curious that, in the sucking-insects, the proboscis is merely composed of the *maxillæ* excessively drawn out, the same instrument being here adapted to a totally different purpose. The insect mouth is completed by a piece above, the *labrum*, and a piece below, the *labium*; making, as has been said, six pieces in all. It is to the *maxillæ* and the *labium* that the two pair of *palpi* are attached, respectively called the *maxillary* and *labial palpi*.



Different parts of the mouth of a beetle.*

* A, upper side; B, under side; C, parts separated: *a a*, antennæ; *e e*, eyes; *l1*, upper lip; *m m*, mandibles; *m x*, maxillæ; *m p*, maxillary palpi; *l2*, labium; *l p*, labial palpi; *c 2*, chin or mentum.

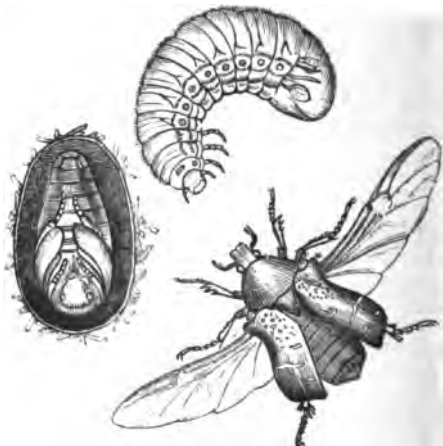
134. ORDER COLEOPTERA (*κολοίς*, a sheath, and *πτερόν*, a wing) comprehends those insects in which the first pair of wings are crustaceous, and serve as defensive coverings to the true wings while at rest, but allow them their proper play when flying. In many instances, however, this is not a correct definition of the order, as some are without wings and sheath; and in many others the latter only is present. The body is also covered with an integument of a similar nature. By means of this crustaceous covering to their wings, beetles are enabled to burrow in the soil, or bore the trunks of trees, without injuring their delicate organs of flight. A beetle, Swainson says, is an insect cased in armour of proof. Let us take a chafer, for instance, or one of those dors whose 'drowsy hum' breaks the stillness of a summer's eve, and examine it closely. With what admirable precision do all the parts of its armour join and fit into each other! It will be almost impossible to insert the point of a pin between any of the joints, and yet the insect moves about without the slightest embarrassment. Not only is every joint, the most minute, either of the antennæ or palpi, completely cased, but even the eyes are often defended in the same manner. They have the hardest covering of all insects—just as the armadillos among quadrupeds, or tortoises among reptiles.

135. The Coleopterans are, of all the orders of insects, the most numerous and the best known. In Britain, they compose nearly a third part of our entire insect population; and the singular forms and brilliant colours which many of them possess, arrest the attention even of persons comparatively indifferent to the wonders and beauties of nature. With respect to their colouring, an eloquent author says: 'Sometimes they resemble the clouds of heaven; at others, the meandering course of the rivers of the earth, or the undulations of their waters; many are veined like beautiful marbles; others have the semblance of a robe of the finest net-work thrown over them: some she blazons with heraldic insignia, giving them to bear in fields sable, azure, vert, gules, argent or or, fesses, bars, bends, crosses, crescents, stars, and even animals.'

136. Beetles undergo a complete metamorphosis. The larva envelops itself in silk, makes a covering of leaves, or burrows in the earth, where it undergoes its change into an inactive pupa, and in due course it assumes its last and perfect form. This Linnæus termed *imago*, because, having laid aside its mask, and cast off its swaddling-bands, no longer disguised or confined, or in any respect imperfect, it is now a true representation or image of its species.

137. The primary division of beetles is founded upon the

number of joints in the divisions of their feet, or *tarsi*, as they are called ; some having five, some four, and some three, while others have them differently parted.



Rose-beetle, in its different shapes.

138. *Section Pentamera* contains the following families :—

139. 1. *Carnivora*.—This family of Beetles has been placed by entomologists at the head of the Order Coleoptera,



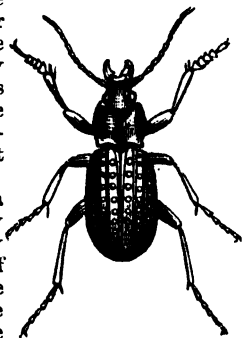
Tiger-beetle.

on account of a certain perfection and development of structure,

by which they are fitted for a mode of life pre-eminently carnivorous. All the organs of mastication, prehension, and locomotion, are of the most efficient kind. Of these the most conspicuous are the mandibles which project from the head, and are armed with strong and powerful teeth. Like the carnivora of the mammals, these insects are remarkable for the beauty of their colours, from which they have derived the name of *Tiger Beetles*. They prey indiscriminately on other insects, and there are few that can resist their attack. Even their larvæ are predatory. In this stage they dig cylindrical holes for themselves in the earth, nearly vertical. This they accomplish with their feet and jaws; at intervals carrying up the earth they detach on the concave part of their head, and throwing it off by a jerk. In these holes they lie in ambush, ready to seize such unwary insects as come within their reach. 'As the excavation is nearly perpendicular at its mouth, they would have difficulty in retaining their position were it not for their dorsal spines, by which they suspend themselves to the side of their dwelling.' The flat plate of their head exactly stops the mouth of the hole, and forms an even surface with the surrounding soil. When they are about to undergo the change to the pupa state, they seal up the entrance of their dwelling, and retire to its innermost recess.

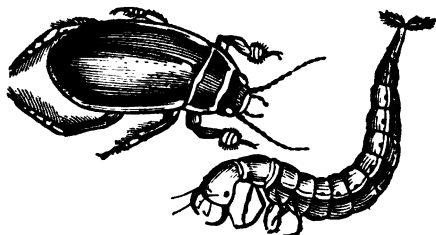
140. The Common Beetle (*Cicindela campestris*) is half an inch in length, of an obscure green above, and each elytron, or wing-covering, has five small white dots. These beetles are usually found in sandy fields, or in heaths exposed to the sun. Another beetle of this family is the *Carabus clathratus*, remarkable for its brilliant colours.

141. Family *Dytiscidæ* (Δύττις, a diver).—The beetles of this family are aquatic in their habits. They have the feet fringed with long stiff hairs, which present a broad surface to the water, otherwise there is little difference in their structure from the former family. Their respiratory apparatus being the same as that of other insects, they are obliged to repair from time to time to the surface of the water in order to breathe. The larvæ suspend themselves at the top of the pool by means



Carabus Clathratus.

of two appendages at the sides of the tail; but when the period of their transformation arrives, they betake themselves



Dytiscus Marginalis—Larva and Imago.

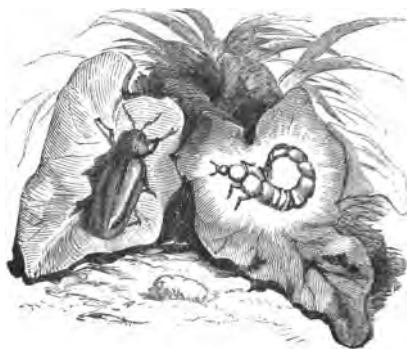
to the land, and burrow in damp situations in the adjacent banks.

142. *Brachelytra* are so called from having short crustaceous wing-coverings. Their body is narrow and elongated, and bears some resemblance to the earwig. This family consists of only one genus—*Staphylinus*. One of the largest species of this genus is frequently seen running about garden-walks. They are easily known by the suppleness of their hinder extremities. When alarmed, or in repelling the attack of an assailant, they bend the abdomen forward over the back.

143. *Serricornes* (*serra*, a saw, and *cornu*, a horn).—This family comprehends such as have serrated or saw-shaped antennæ, and the elytra completely covering the body. The wire-worm, so well known in this country, is the larva of the *Elator obscurus*. The damage it occasions by devouring the roots of corn is sometimes of vast extent, and attended by most disastrous consequences.

144. Another interesting genus is the *Lampyris* or glow-worm, so remarkable for the brilliant light which it emits at night. The body of this beetle is soft, and the light resides in the two or three last sections of the abdomen. In the south of England, in the summer months, they are found at the sides of roads, in hedges, and among grass. The female especially possesses the luminous property. They are often employed by the inhabitants of those countries where they prevail, as a substitute for artificial lights. 'The Indians are said to have formerly used them in their hunting and fishing expeditions; and when travelling in the night, they were accustomed to fasten them to their feet and hands.' Southey

refers to them in his *Madoc*, as furnishing the lamp by which



Glowworm.

Coatel rescued the British hero from the hands of the Mexican priests :

‘She beckoned, and descended, and drew out
From underneath her vest a cage, or net
It rather might be called, so fine the twigs
Which knit it, where, confined, two fireflies gave
Their lustre. By that light did Madoc first
Behold the features of his lovely guide.’

145. The Death-watch (*Annobium pertinax*) derives its specific name from the pertinacity with which it feigns death, ‘preferring to be roasted by a slow fire rather than shew the least sign of life.’ In the larva state, it employs itself in perforating furniture and books, which, when they have suffered much in this way, are said to be *worm-eaten*. The noise which the little animal makes with its jaws in this work, resembles the ticking of a watch, and is heard whenever an unusual silence prevails. As this is usually the case in a sick-chamber, the noise is apt to be heard before any one dies, and, by a natural process of the ignorant mind, is held to be a warning of death. Hence the name of *death-watch*.

146. The family *Clavicornes* are characterised by having the extremities of the antennæ thick, and often terminated by a perfoliated or solid mass. They have only two pair of palpi—one of them affixed to the maxillæ, the other to the under-lip. The elytra completely cover the upper side of the abdomen or its greater portion. They are partly terrestrial and partly aquatic. The most remarkable genus of this family are the

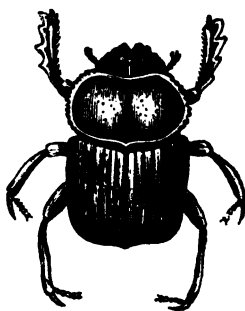
Burying-beetles (*Necrophorus*), so called from their habit of burying small quadrupeds, such as mice and moles. When they find a carcass, they creep beneath it, and dig away the earth till the hole is sufficiently deep to receive it. After it is interred, they deposit their eggs in the carcass, upon which the young feed during their larva state.

147. The family of *Palpicornes* possess, like the last family, long antennæ, terminated in a club, which is commonly leaf-like. The body is generally ovoid. Their feet are suited for swimming. The genus *Hydrophilus* comprises the largest species in the tribe. *H. Piceus* is an inch and a half long, oval, of a black-brown colour. It is common in Britain, frequenting ponds and ditches. It swims and flies well, but walks badly. The females construct cocoons of silk; the outer surface is coated with a gummy matter, which renders it impervious to the water on which they float.

148. The family of *Lamellicornes* are so called from the antennæ terminating in a club or large knob, composed of laminæ or thin plates, arranged like the leaves of a book, which they can open or shut at pleasure. They feed entirely upon vegetable matter, either in a green or decomposed state. Among them we find great diversity of form, size, and colour. The *Cetonia aurata*, or Common Rose-beetle, may be taken as the type of the whole. A glance at this beautiful, though common insect, will convey a better idea of the general shape of the lamellicorn beetles than the most laboured description. Their food consists of manure and the roots of vegetables. See page 50.

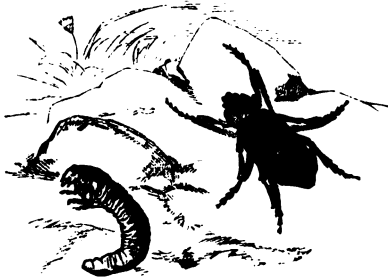
149. The sacred Egyptian Beetle (*Ateuchus sacer*) was one of the creeping things to which that remarkable people paid divine honours. It was consecrated to the sun, and was therefore regarded as the emblem of fertility.

150. Some of the best known of our native Coleoptera belong to this family—as the Stag-beetle and Cockchafer. The Stag-beetle (*Lucanus cervus*) is a very large insect, the male measuring two inches in length. It is found in the southern counties of England. It pierces the bark of trees, and lives on the sap. The Cockchafer (*Melolontha vulgaris*) abounds in England, but is rare in Scotland. In its larva state it consumes the roots of grass, and other



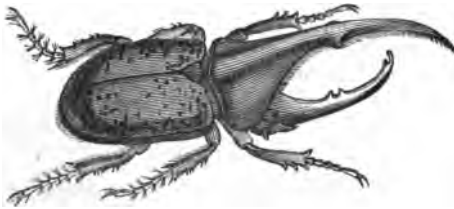
Ateuchus Sacer.

herbaceous plants. The perfect insect is equally destructive to the leaves of our forests and woods.



Cockchafer.

151. A most remarkably formed species is the *Dynastes Hercules*, a native of Brazil, which attains the length of five inches, and of which the male possesses an enormous horn projecting from the head, which is opposed by a corresponding protuberance from the thorax.

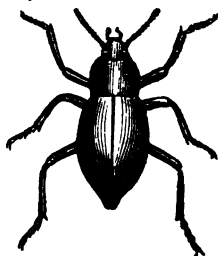


Dynastes Hercules.

152. Having described the habits of a few of the beetles, we shall give little more than the classification of the remainder.

153. *Section Heteromera*.—The name signifies that the legs have a different structure from one another: while there are five articulations in the first four tarsi, there are only four in the hindmost pair. They are terrestrial in their habits, and chiefly dwell in dark places, such as cellars, stables, and the like. Their food consists of vegetable substances. This section comprises four groups.

154. *Melasoma*, as their name implies, are for the most part black, or of an ashy colour, and unvaried. They are distinguished also by hard wing-coverings, wings generally wanting, claws simple, and maxillæ with a hook. They live for the most part in the ground beneath stones, or in the sand, and in low and dark parts of buildings. They are very tenacious of life. The *Blaps mortisaga* is a well-known example, being often found in dark and dirty places about houses.



Blaps Mortisaga.

155. Another, *Tenebrio molitor*, is very common in England, being found, especially in the evening, in bakehouses and corn-mills. Its larvæ, called the meal-worm, is long, scaly, and smooth.

156. *Taxicornes* (*taxus*, a yew-tree, and *cornu*, a horn) includes those coleopterous insects in which the antennæ gradually augment in size as they extend from the head, or terminate in an enlargement. Their claws are simple, and maxillæ without a hook. They are generally found in the fungi which grow on trees, or beneath the bark. Examples—*Diaperidæ* and *Coryphidæ*.

157. *Stenelytra* (*στένις*, narrow, and *ἔλκτρον*, a sheath) are so called from the wing-coverings being narrow at the posterior part of the body. Examples—*Helopidæ* and *Cistelidæ*.

158. *Trachelides* (*τράχηλος*, a neck).—The insects of this section have the head supported on a kind of pedicle or neck. Examples—*Meloë*, *Mordellattoria*, and *Lagria*. The Blister Beetles (*Meloë vesicatorius*) are more plentiful in Spain than in any other country of Europe, and are well known by the name of Spanish Flies. They are collected for commercial purposes, chiefly in the month of June. They are shaken from the branches of trees and shrubs which they frequent, such as the ash and lilac, and received in sheets spread upon the ground. They are then killed by being held in hair-sieves over the fumes of vinegar, and afterwards dried either by exposure to the sun, or by being placed on hurdles covered with cloth or paper in a well-ventilated apartment.

159. *Section Tetramera* contains such beetles as have four joints in each foot. They all feed upon vegetable substances. The perfect insect is found upon the flowers or leaves of plants, while many of the larvæ occupy the interior of fruits or seeds, where they have been deposited by the mother, and furnished with a house of defence and food for their support.

This section is divided into seven families, the chief of which is that of the *Curculionidæ*, or Weevils. These are easily distinguished from other beetles, by the prolongation of the anterior part of the head into a kind of muzzle. They include some of the most dangerous enemies to our vegetable stores. Another family, *Xylophagi*, have their name from the habits of their larvæ as destroyers of wood. A third, the *Longicornes*, are remarkable in the same way; of this family an English species, *Callichroma moschata*, is beautifully coloured, and exhales an agreeable musky odour.

160. *Section Trimera*, or the Beetles which have only three joints.—This division is of comparatively limited extent. To it belong *Fungicolæ* (*fungus*, a mushroom, and *colo*, I inhabit); found on mushrooms. A pretty little species of this family found in England is the *Coccinella vigintiduopunctata*, so called from its having eleven white spots on each wing-covering. The *Aphidiphagi* prey upon aphides, or plant-lice.

161. ORDER ORTHOPTERA have the wings, when at rest, disposed in straight longitudinal folds: hence the name. The wing-coverings are called tegmina. These consist of a stiff substance resembling parchment, and serve the purpose not only of protecting the inferior wings, but also of assisting in flight. The Orthopterous insects are terrestrial in all the stages of their existence. Some are carnivorous, or omnivorous; but the greater number feed on living plants. Their mandibles are large, powerful, and efficient.

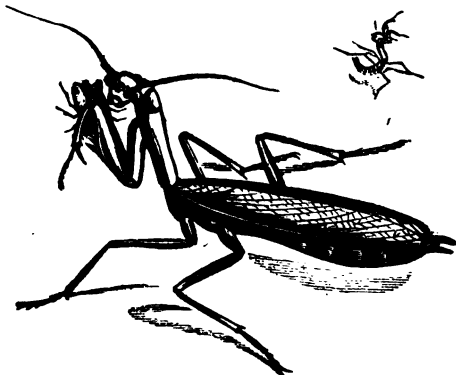
162. This Order consists of two sections. The first of these, *Cursoria*, have the hind-legs entirely fitted for running, and are divided into four families.

163. Family *Forficulidæ* (Earwigs) 'are furnished with ample and curious wings, the principal nervures of which are so many radii diverging from a common point near the anterior margin. Between these are others, which, proceeding from the opposite margin, terminate in the middle of the wings. These organs, when at rest, are more than once folded, both transversely and longitudinally.' Earwigs are very common in damp situations, where they frequently assemble in large troops under stones, or the bark of trees. They are obnoxious to gardeners, on account of the injuries they commit upon fruits and flowers. The dahlia, in particular, is often disfigured by their attacks. It is a vulgar and absurd notion that they creep into the ears of sleeping persons.

164. Family *Blattidæ* (Cockroaches) are nocturnal insects, certain species of which infest kitchens, bakehouses, and

corn-mills, while others are found in the fields. Most of them are of a uniform brown colour; their wing-covers are generally as long as the abdomen, and their wings are folded only longitudinally. One of the species, *Blatta Orientalis*, so called because it is supposed to have been originally brought from the East, is about an inch in length, and is well known for its destructive propensities. It attacks not only eatables, but gnaws woollen and silk materials, and even shoes.

165. Family *Mantidæ* are characterised by a narrow body, and their legs are unequal; the anterior pair, which are serrated, being longer than the others. They are all carnivorous in their habits, as might be inferred from their large mandibles; and are so pugnacious, that in China the children keep them in small cages, and amuse themselves by putting two together, when they immediately fight like game-cocks. Roësel, who kept some of these insects, observes, that in their mutual conflicts, their manœuvres very much resemble those of hussars fighting with sabres. Sometimes one cleaves the other through at a single stroke of its leg, or severs the head from the body. One species, the *Mantis religiosa*, is regarded by the inhabitants of the countries it inhabits with superstitious reverence, on account of its attitude, recalling the appearance of a man engaged in prayer. This is, however, the position in which the creature lies in wait for its prey. They are chiefly confined to the tropical and warm regions of the globe.



Mantis Religiosa.

166. Family *Phasmidæ* (or Spectre Tribe).—This family is distinguished from the *Mantidæ* by having all the legs of equal

dimensions, or nearly so. Their mandibles are, however, adapted for gnawing. They live exclusively on vegetables. This family is rarely found beyond the tropics. Some of the species surpass all other insects in length. *P. Gigas* is said to measure nine inches from one extremity to the other. Another species is remarkable for the similarity its wing-coverings bear to a laurel-leaf.

167. *Section Saltatoria* consists of three families.

168. Family *Achetidæ* (the Cricket Family) are a very noisy race. The chirping of the House-cricket, *Gryllus domesticus*, is heard, under favourable circumstances, at a distance of more than a hundred yards. The noise is produced by the friction of the cases of the elytra against each other; and though harsh, gives life to solitude, and conveys to the mind the idea of a perfectly happy being; hence the expression, 'as merry as a cricket.' It is found chiefly in bakehouses, and feeds on insects. The Field-cricket and Mole-cricket also belong to this family.

169. Family of *Gryllidæ* (Grasshoppers) are distinguished by very long antennæ, always as long as their body, and frequently even of greater length. The head is perpendicular, or slightly incurved. They are all herbivorous. Few of them inhabit this country; and such as we possess are of small size, compared with those of foreign lands. These are the little chirpers which we hear in heaths and sunny banks. They begin their song long before sunrise: in the heat of the day it is intermitted, and resumed in the evening.

170. Family of *Locustidæ* (Locusts).—Their antennæ seldom



Locust.

exceed half the length of the body. They have coloured elytra, and large wings, disposed when at rest in straight

fan-like folds. They fly by starts, but frequently rise to a great height. 'Certain species unite in vast numbers and emigrate, resembling a dense cloud in their passage through the air. Wherever they alight, all signs of vegetation disappear, and cultivated grounds are left a desert.' The second chapter of Joel gives a powerful description of the devastation committed by these destructive insects: 'The land is as the garden of Eden before them, and behind them a desolate wilderness; yea, and nothing shall escape them.' In some places they are used as food; but they form a poor substitute for the provisions they have destroyed.

171. ORDER NEUROPTERA (Nerve-winged Insects) are characterised by four naked membranous wings, reticulated or interlaced with a delicate net-work, and fully fitted for flight. In general, the wings are of an equal length, though in some families the posterior pair are smaller than the others, and in a few cases they are entirely wanting. Some of the Nerve-winged Insects pass through a semi-metamorphosis merely, the rest undergo a complete transformation. The majority of them are carnivorous in the larva state, as well as when they are perfect insects.

172. The family of *Libellulidæ* (Dragon-flies) are distinguished

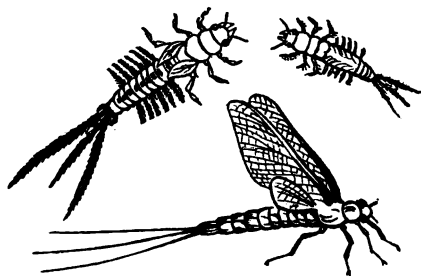


Dragon-fly.

by the slender form of their body, and beautiful and varied colouring. Their wings are large, and generally extended horizontally, and at right angles to their body during repose. In velocity and protracted duration of flight they excel all other insects, and they can dart backwards or sidewise with equal ease. In the two first stages of their existence, Dragon-flies live entirely in the water; and when they become winged

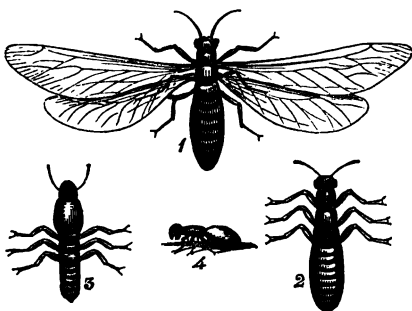
insects, they haunt the precincts of that element on all occasions. At the time of oviposition, the female places herself upon a plant close to the edge of the water, into which she thrusts the extremity of her body and deposits her eggs.

173. Family *Ephemeridæ* (ἡ' = ἐπὶ, upon, and ἡμέρα; a day), Day-flies, are so called from the short duration of their life in



Ephemera Vulgata—Larva, Pupa, and Imago.

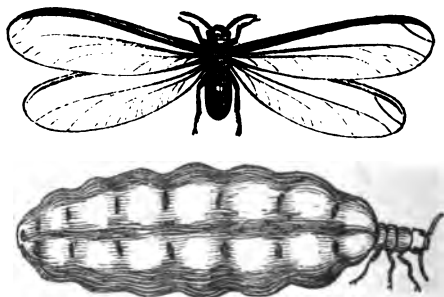
the perfect state, which is frequently limited to twenty-four hours; though, as larvæ, their existence extends throughout two or three years. They carry their wings always elevated perpendicularly. They are seen in summer and autumn sporting in every variety of evolution over ponds and brooks. The May-flies (*Ephemeres albipennes*) are the largest of the British species, both in the larva state and as perfect insects. They are a favourite food of the fresh-water fishes, and on this account form excellent bait for anglers.



1. and 2. Perfect Termites; 3. Soldier; 4. Worker.

174. Family *Termitidæ*, White Ants (*termes*, the branch of

a tree), are so called because some of them affix their nests to branches. They are terrestrial, and carnivorous or omnivorous in all their stages; and perform a considerable share in the labour of completing the comminution and destruction of dead and decomposing organised matter. They are the only insects of the order that exhibit social habits. They form large communities, consisting of males and females, possessing wings;



Queen in the winged state, and when filled with eggs.

and neuters, which are wingless, and act the part of soldiers. The larvæ are familiar to us as the portion of the community engaged in work. Some species excavate and occupy the trunks of trees; they also infest dwelling-houses, where they commit great damage, by excavating in a similar manner the beams, rafters, and furniture. It is asserted that the superb residence of the governor-general at Calcutta, which cost the East India Company such an immense sum, is now rapidly going to decay, in consequence of the attacks of these insects. Other species construct nests on the ground, of a conical form, of hard mortar. These are sometimes elevated to a height of eight and ten feet; and where there are numbers of such pyramids, they appear at a distance like a small village.

175. When arrived at their perfect state, the Termites quit their habitation, and fly abroad during the evening and night, but lose their wings before morning, and falling to the ground, numbers of them become the prey of birds and lizards. The workers collect as many of the females as possible, and enclose them in large cells, in order to the establishment of fresh colonies. Although probably all are of tropical origin, a few species have located themselves in the south of Europe.

176. Family *Myrmelionidæ* (Ant-lions).—The destruction which their larvæ make amongst ants has gained for them

their family name. The economy of these insects in their larva state is very interesting. They inhabit dry sandy situations, where they form a funnel-shaped hollow, the top of which is sometimes a foot in diameter, the sides being formed of such



Ant-lion.

loose sand, that any insect approaching the edge inevitably slides down. The ant-lion, having stationed itself at the bottom of the hole with the jaws only exposed, is ready to seize its prey, which, when obtained, it sucks completely dry. Having thus exhausted its juices, the husk is placed upon its head and legs, and a sudden jerk casts it beyond the outer circle of the pitfall. When the ant-lion attains its perfect state, it loses its carnivorous propensities, and revels upon the nectar of flowers. It rarely flies during the day, but chiefly towards the evening. The common European species, in its perfect state, is about an inch in length. Its wings are transparent, black, and dotted with white.

177. ORDER HYMENOPTERA, or Membrane-winged Insects, resemble the Neuroptera, but cannot well be mistaken for them. The anterior and hinder wings, the former of which exceeds the others in size, are in flight hooked together, so as to produce one continuous margin. These organs exhibit fewer nerves than in the former order. Though considered as mandibulate insects, the Hymenoptera have the maxillæ modified in such a way as to enable them to live in a great degree by suction. A more distinguishing characteristic is perhaps the appendage at the tail, either in the form of a sting or ovipositor. They are distributed over the whole world ; and some of them, by their production of wax and honey, are exceedingly serviceable to man. When we add, that the order comprises Bees, Ants, Gall-flies, Wasps, and Ichneumons, it will be apparent

that the Hymenoptera possess instinct in a higher degree than any other kind of insect.

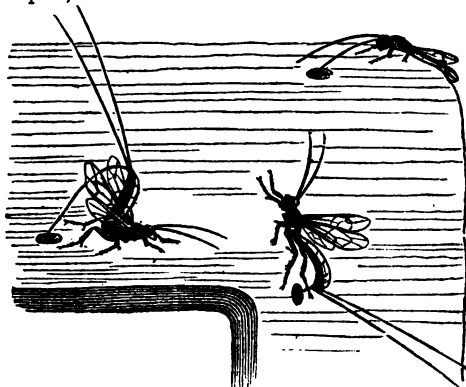
178. This order has been divided into the following families :

179. Family *Tenthredinidæ* (Saw-flies).—The female insects of this family are furnished with an ovipositor—an instrument placed at the extremity of the abdomen, combining the properties of a saw and a file. By its means, the insect makes a succession of small holes in the branches or other parts of trees, in each of which an egg is deposited, accompanied with a drop of frothy liquid, which closes up the hole. Sometimes, however, the ova are attached to leaves. An instance of the former mode of oviposition is observed in the Rose Saw-fly; while a familiar example of the latter is found in the species which infest gooseberry and currant bushes. The larvæ of this family bear a strong resemblance to the caterpillars of butterflies and moths, but are easily distinguished by the number of their feet, being from ten to sixteen.

180. Family *Ichneumonidæ* (Ichneumons) have obtained their name from the Ichneumon quadruped which destroys the eggs of the crocodile while they are hatching in the sand, and thus limits the increase of that formidable reptile. In a similar manner, the Ichneumonidæ are useful in diminishing the numbers of destructive insects. This family is so numerous, that scarcely an insect exists which in its larva state is not exposed to the attacks of one or other of the species. Inserting their stings into the larvæ of other insects, they there deposit their eggs, where the young, when hatched, find a sufficiency of food. The grub ultimately falls a victim to its ravages; but this event seldom takes place till the young Ichneumons have attained their full growth; and, what is very remarkable, they carefully avoid injuring the vital parts of the larva on which they prey.

181. Family *Cynipsidæ* (Gall-flies).—These insects deposit their ova in living trees, and the irritation excited by their presence gives rise to the formation of excrescences, called *galls*, such as those so frequently observed on the leaves of the oak-tree. While some of these tumours resemble seed-vessels, others are of a globular form, a bright red colour, and smooth, fleshy consistence, resembling beautiful fruit. Their situation on the plant is also diversified—some being found on the leaf itself, others on the footstalks only; some on the roots, and others on the buds. 'Some of them cause the branches upon which they grow to shoot out in such singular forms, that the plants producing them were esteemed by the old botanists as distinct species.' The larvæ feed on the interior of their habitations, where they generally remain five or six months.

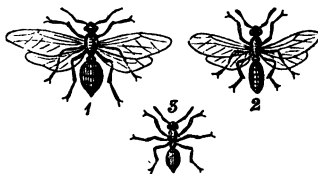
Some undergo their metamorphoses within the galls, while others depart, in order to descend into the earth. The small



Pimpla Manifestor engaged in oviposition.

round holes, observed in the sides of these excrescences, shew that the insects have made their escape. Galls form an article of commerce; they are imported from the Levant, and used in the manufacture of writing-ink and black dyes.

182. Family *Formicidæ* (Ants), so celebrated for their industry, live in societies, often of great extent. In this and some other hymenopterous families, there is a curious and peculiar sexual arrangement—one large portion of each society being unfitted for reproduction (neuters), and designed only to act as nurses of the young, the production of which is the duty of a limited number of true females. This duty of providing food for, or nursing the young, is what has given ants and bees their great reputation for industry. The males and females are found only temporarily in the ant's nest, from which they make their escape as soon as they have gained their wings. The males soon die. The females pull off their own wings with their feet, and become the founders of new and distinct colonies. The nature and form of the nest vary according to the instinct of the



Formicidæ—1. Female; 2. Male;
3. Neuter, or Worker.

different species. They are most generally established in the ground, the nests being entirely hidden, or forming conical mounds; some inhabit the trunks of old trees, which they pierce in every direction.

183. The neuters feed the young grubs, and move them on fine days to the outer surface of the nest, in order to give them heat, removing them back at the approach of night or bad weather. They defend them from enemies, and take the greatest care of them and of the pupæ. The neuters pass the winter in their nests in slumber, with more or less pertinacity, according to the severity or mildness of the season.

184. The food of the ants consists chiefly of aphides or plant-lice. None of the European species hoard grain for the winter, but they display a sagacity no less wonderful in forming a provision for themselves. 'Many of them,' says Huber, 'collect the eggs of aphides, deposit them in their own nest, and guard them with the greatest care till hatched; and then, as we pasture milch kine, they continue to keep an eye over them, for the delicious nutriment they afford.' There is, however, a species in India which hoards up the seeds of grass, and to it the lesson of Solomon may have referred: 'Go to the ant, thou sluggard; consider her ways, and be wise: which having no guide, overseer, or ruler, provideth her meat in the summer, and gathereth her food in the harvest.'—*Prov. vi. 6, 7, 8.* Some ants are gifted with double means of annoyance, as they can sting as well as bite. Our indigenous species may be regarded as comparatively harmless.

185. The *Vespidæ* (Wasps) generally form large societies, composed of males, females, and neuters. A colony is commenced in the spring by a single female, which has lain dormant and survived the severity of winter. She lays eggs, which soon produce neuters or labourers. Assisted by a numerous army of these coadjutors, she proceeds to enlarge the nest, by detaching particles of old wood or bark, and moistening and reducing them into pulp. This, when dried, forms a paper-like substance, suitable for the purpose of building. The neuters, under the guidance of the parent-wasp, tend subsequent broods till the beginning of autumn. The young males and females then appear abroad. The number of females in a wasp's nest generally amounts to several hundreds. Of these very few survive the winter; such as are so fortunate, remain torpid till the vernal sun recalls them to life and action. And they again, in their turn, lay the foundations of new colonies. The males take no part in building the nests or in tending the young, but are the scavengers of the community, sweeping the passages and streets. It is their duty also to remove the

dead bodies. To accomplish this work, two generally unite their strength; but if a partner is not at hand, the wasp so employed divides the dead body into parts, and thus effects his purpose. With the exception of a few of the females, the whole community perishes on the approach of winter.

186. Family *Apidæ* (or Bees) compose a large group, which are well known from the universal reputation of the typical genus *Apis*, of which the domestic bee is a species. Living in detached communities, under the apparent rule of an individual, the domestic bees furnish us with an emblem of monarchical government, whilst their steady industry in storing up provision for the contingencies of a barren period, has been the theme of sages and moralists, as an example for the indolent of their own species. The average number of each community has been computed at about 16,000. One only of each hive is a true female, distinguished by her size, and denominated the *queen*. About 600 are males, usually called



1. Queen; 2. Drone; 3. Neuter Bee.

drones; and the remainder, consisting of upwards of 15,000, are *neuters*, destined to labour. The queen, in the larva state, is furnished with a cell of royal dimensions, of a cylindrical form, and she is supplied by her nurses with food of the most nutritious and delicate kind, called by bee-farmers royal jelly, extracted from flowery juices. When arrived at full growth, she spins within her cell a silken shroud; therein she changes to a nymph or pupa, and in due time comes forth in all the dignity of majestic size and splendid colouring. The labouring-bees find themselves, when emerging from the egg, inhabitants of six-sided cells, so proportioned as to limit their growth, and prevent their full development; they are supported on the

simple fare of bee-bread—a substance composed of pollen and honey. The males or drones exist only between April and August, when they are destroyed by the workers as useless.

187. The wax of which the bees construct the cells required for the storing of their honey and other purposes, is secreted by them in little scales, in which state it works out from between the segments of the abdomen. These are taken up and kneaded by the jaws, and applied in the proper place. The cells are built in a hexagonal, or six-sided form, being that which gives the nearest approach to the circular, with the least expenditure of material, and at the same time the greatest strength. The bottom of each cell on one side abuts against three on the other, and is supported by the divisions between them. It is formed of three plates meeting at an angle, and this angle has been ascertained by a very intricate calculation, to be *precisely* that which enables the greatest strength to be obtained with the least material; the instinct of an insect thus coming to the very same result as the highest human intelligence. Some of the cells thus formed are employed as store-rooms for honey and pollen, and in others the eggs are laid. The eggs from which perfect females or queens are to be produced, are laid in cells much larger than the rest, and of different form; but if, from any cause, these should not afford a sufficient number, the bees have the power of rearing a female or queen from a neuter grub, by feeding it with an aliment more stimulating than the pollen. The drones are killed at the end of summer, but the queen and great part of the workers remain; and when, in the summer, they increase so much as to over-people the hive, colonies are sent forth with young queens, in search of another habitation.

188. One of the most marked features of the wasps and bees, is the possession of a sting, situated where the ovipositor is placed in other hymenopterous insects. With the use of this instrument, the bee or wasp can penetrate our skin, and introduce a poisonous fluid capable of inflicting very considerable pain.

189. The remaining orders of insects are *Haustellate*—that is, possessed of a mouth formed for suction.

190. ORDER HOMOPTERA have the fore-wings of the same consistence throughout, often somewhat parchmentsy, and, when folded, they incline at an angle like the roof of a house. All the animals of this order feed on vegetable juices, for obtaining which their tongue is elongated and channeled like a gutter, and surrounded by delicate lance-like organs for piercing the

tissue of plants. The females of some species are furnished with an ovipositor, provided with several toothed saws, by means of which they make incisions into the leaves and stems of plants, and thus introduce their eggs into a place suitable for bringing out the larvæ.

191. Family *Cicadidæ* have their type in the well-known *Cicada*, so much celebrated by the poets for its fine song. Most of the species are confined to warm climates, and only a small one exists in England. The shrill chirp of the cicada is alluded to by many poets. One bard entreats the shepherds, 'To spare that nightingale of the nymphs.' Anacreon calls it 'Sweet prophet of the summer;' and Virgil alludes to it when he says: 'Et cantu querulæ rumpent arbusta cicadæ.' Byron describes them as 'The shrill cicadæ, people of the pine.' No author has given a better idea of the singing of a cicada than old Marcegrave, who says its tune begins with *gir, guir*, and continues with *cis, cis, cis*. The animal produces its sound by a peculiar apparatus situated beneath the abdomen. Among the Cicadidæ are found the largest of the homopterous insects, some species measuring seven inches across the wings.

192. Family *Aphides* (Plant-lice) inhabit trees or plants, to which, notwithstanding their generally small size, they prove highly destructive. They are frequently seen on rose-buds, and on the honeysuckle, presenting a green mass of moving life; and the sweet honey-dew which is found on the leaves of these plants, and various other trees, is a substance extracted by these little insects from the sap, and afterwards ejected in a state of the greatest purity. The astonishing fecundity of the Aphides has no parallel in the animal creation; and were it not that these immense multitudes are called into being to furnish food for other races, they would be sufficient to extirpate vegetation from the surface of the earth.

193. Family *Coccidæ* (Blight Insects).—The males have only two wings, which lie horizontally on the body, one over the other. The females are without wings. The cochineal insect (*Coccus cacti*), a species of this family, is esteemed for the splendid colour it furnishes. It was first imported into this country from Mexico, about the middle of the sixteenth century. The animals are scraped from the cactus plants, which they inhabit, into bags, killed by boiling-water, and dried in the sun. Though the Spaniards, on their arrival in Mexico in 1518, found cochineal dye employed by the natives, yet its true nature was not ascertained for nearly two centuries afterwards. Acosta, indeed, as early as 1530, stated it to be an insect; but Europeans generally, misled by its external appearance—resembling that of a reddish shrivelled grain—believed it to

be the seed of a plant. The quantity annually exported from Mexico has been said by Humboldt to realise half a million sterling. It takes 70,000 insects to make a pound of cochineal. Another species, which belongs to the East Indies, produces gumlac, a substance made use of in the manufacture of beads, rings, and other ornaments; mixed with sand, it forms grindstones. In this country it is chiefly employed in the composition of varnishes, sealing-wax, and japanned or lacquered ware. A species in China is used for the manufacture of wax-tapers.

194. Family *Fulgoridae* are distinguished by a curious prolongation of the forehead, which sometimes equals the rest of the body in size. In it is said to reside the luminosity which has given rise to the family name—a property, however, which has been doubted by many naturalists. The



Fulgora Laternaria.

species are all vegetable feeders, and greatly destructive. Some species in China make a certain compensation for this by producing a secretion, from which a fine white wax is manufactured.

195. Family *Cercopidae* are insects of small size, remarkable for the grotesqueness of the forms which many of them assume,



Boidium Cruciatum.—*Boidium Globulare.*

of which an example is here given in two Brazilian species. Some species inhabit this country, the larva and pupa being

remarkable for causing that expunction on plants which children call cuckoo-spit or gowk-spittle.

196. ORDER HETEROPTERA are the co-relatives of the Homoptera, being distinguished from them by having the fore-wings of diverse consistence, coriaceous at the base, and membranous towards the point. They are chiefly supported by vegetable juices; but some are remarkable for preying on the juices of the larger animals. The majority are confined to tropical climates, and the species which inhabit these regions are mostly ornamented with a great variety of beautiful colours and markings. In some species the wings are undeveloped, or the upper pair is wanting.

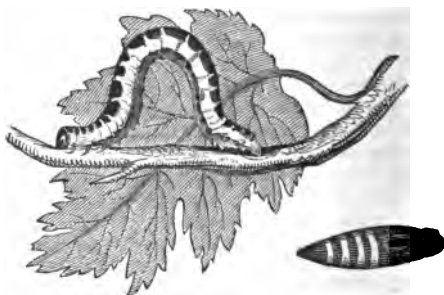
197. Family *Cimicida* (Bugs) are unhappily familiar to us, by the intrusion of a well-known species into our bed-chambers. It is believed that this disgusting insect was brought first to Europe early in the sixteenth century, by the return of the first voyagers from America. It has derived its name—Celtic for a hobgoblin—from its nocturnal and stealthy habits. The bite is generally attended by a poisonous effect, and there is a particular species said to be able to communicate a slight electric shock.

198. The *Water-bugs*, or *Boat-flies*, haunt the surface of still waters, moving rapidly along on their backs by means of their oar-like hind-legs, and using the front pair, which resemble a pair of hooks, in seizing small aquatic insects. They are furnished with wings, which they use in transporting themselves to new fields of depredation.

199. The *Nepidæ* (Water-scorpions) are fierce insects which lurk in the mud or weeds of ponds and streamlets, living solely upon insects. They seize and hold their prey with their long lobster-like fore-arms, and pierce it with their beak; a pointed hollow weapon serves the further purpose of sucking the juices of the struggling victim. Their prevailing colour is a blackish brown, scarcely distinguishable from the mud in which they love to lurk. In the twilight they frequently leave the water, for the purpose of seeking elsewhere a similar abode.

200. ORDER LEPIDOPTERA (*Moths* and *Butterflies*) derive their name from a conspicuous peculiarity of their wings, the ordinary membrane of these organs being covered with a multitude of minute scales (*λίπιδος*, a scale), set or planted therein, like the tiles on the roof of a house. The colours, which render the wings of many of the order so beautiful, reside in these scales, of which as many as 400,000 are reckoned to exist in a

single silk-fly. The Lepidoptera subsist exclusively upon fluid nutriment, for obtaining which the maxillæ are so fashioned that they lock together with teeth into a single tube. All of this order are either males or females; neuters, which are so prominent among the Hymenoptera, are not found in the Lepidoptera. They go through a perfect metamorphosis. From the eggs deposited on the leaves of plants, proceed in due time the larvæ, or caterpillars, each species being generally placed on the kind of plant which it is fitted or inclined to eat. When it has attained its full size, it spins round its body a cocoon or case of silk, in which to spend its life as a *pupa* or *chrysalis*. This is an important habit on the part of the insect, as from one species we derive the silk which we weave into one of the most elegant kinds of cloth. The threads are formed by a glutinous secretion from glands, which seem analogous to the salivary glands of other animals; forced out through a small opening at the end of the lip, it hardens as it dries in the air. Some Lepidoptera form no cocoon, but hang in the pupa



Caterpillar and Chrysalis of the Magpie Moth.

state by a thread from some lofty place. At the proper time, the perfect insect bursts from its case, to spend a brief gay existence in the air, to lay its eggs, and then perish.

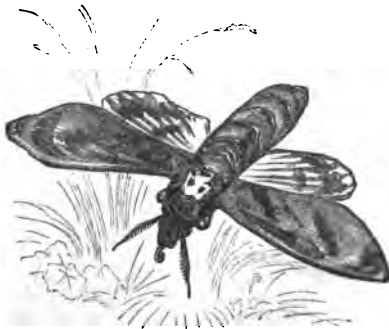
201. Family *Papilionidæ* (or Butterflies), otherwise called *Diurna*, are distinguished by the extraordinary beauty and variety of the colours which adorn their wings; and the number of species, each having some marked peculiarity, is enormously great. It is believed that not less than 2000 species exist in Britain alone. Beautiful as are many of these, there are still more splendid examples in other countries. Some of the foreign species exhibit an expanse of wing not less than nine inches; some display a metallic brilliancy of hue absolutely

dazzling. The accompanying figure gives a good representation of the general aspect of the diurnal Lepidoptera.



Argynnis Paphia.

202. Family *Sphingidæ* (or Hawk Moths), otherwise called *Crepuscularia*, from their general habit of flying abroad in the twilight, live in much the same manner as butterflies. They are of a duller colour, and in flying make a loud humming noise. One species, noted for a skull-like patch of colouring on the back of the thorax, and thence called the Death's Head Moth, emits a squeaking kind of sound. In consequence



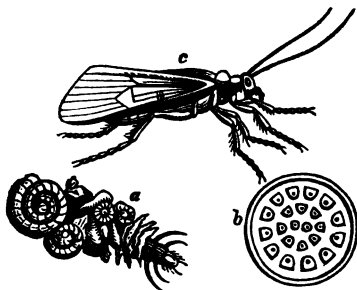
Death's Head Moth.

of the peculiar aspect of its body, the sudden appearance of this insect has been popularly regarded as ominous of evil. It has a really formidable character towards bees, whose hives it

enters boldly, scattering the inhabitants in alarm, and then preying upon the honey.

203. Family *Nocturna* (or Moths Proper) fly only by night, and are of a dull style of colouring. The most important tribe is that of the *Bombycidae*, comprising the silk-worm and allied species. The silk-worm (*Bombyx mori*) is a native of China, where it has been domesticated for at least 3000 years. It was imported into Europe in the reign of the Emperor Justinian, 550 A.D. It is said that two Persian monks who had long resided in China, and had made themselves acquainted with the mode of rearing the silk-worm, succeeded in bringing some of their eggs to Constantinople. These were hatched, and a sufficient number of the butterflies were saved to propagate the race. Thus a new and important branch of industry was established in Europe. The caterpillar of the silk-worm, when it has attained its full growth—about three inches in length—proceeds to enclose itself in an oval-shaped ball or cocoon, preparatory to its assuming the state of the chrysalis or moth. The cocoon is formed by an exceedingly slender and long filament of fine yellow silk, emitted from the stomach of the insect. After emancipating itself from its silken prison, it seeks its mate. In two or three days afterwards, the female having deposited her eggs, from 300 to 400 in number, both insects terminate their existence.

204. The *Phryganea* is the type of a family, which some naturalists have placed as a distinct order, under the name of *Trichoptera*; while others assign it a place among the *Neuroptera*. The insects resemble the *Lepidoptera* in the distribution of



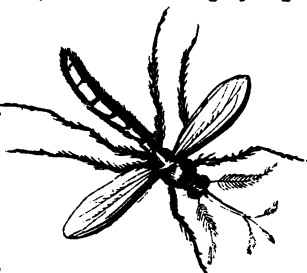
Phryganea Grandis.—a. Larva in its case; b. Grating; c. Imago.

the nerves of the wings, and the hairy covering with which both the wings and bodies are beset. The most remarkable

peculiarity is seen in the larva state, when the creature—recognised as the Caddice-worm—resides in a cylindrical case, open at each end, to which they attach bits of stick, weeds, pebbles, or even small living shells, by the assistance of silken threads which they spin from their mouths. With the first three segments of the body protruded, they creep about with this case to feed, but withdrawing to the inside on the least alarm being given. When about to assume the pupa state, they fix their cases to some solid substance beneath the water, and close the two extremities with a kind of grating, so as to keep out everything but the water, which they require for respiration. Finally, in due time ascending to the air, they pass into the perfect state.

205. ORDER DIPTERA (or Two-winged Insects) are generally characterised by the peculiarity from which the name of the order is derived. The two wings correspond to the anterior pair in four-winged insects; besides which there are two short clubbed appendages, called balancers, which seem to be the rudiments of the posterior wings of other orders. Their mouth is formed for sucking, and their eyes are directed laterally. Many species of this order are useful in devouring obnoxious insects and consuming dead carcasses, and other decaying animal matter, which would otherwise pollute the atmosphere. Some, however, are a source of great annoyance and damage. The bite of the mosquito, for example, renders that insect the plague of every country in which it is found. Many species deposit their eggs upon the bodies of our domestic animals, so that their larvæ may there obtain nourishment. Others infest our viands or cereal plants for the same purpose.

206. Family *Culicidæ* (Gnats) are the most highly organised of all the Diptera; and the perfection of their suctorial apparatus, which is furnished with six lancets, many of us can attest from our individual experience of what is called the sting of a gnat. Their larvæ are aquatic, being those singular little red worms, thick at one extremity, which we frequently observe in stagnant waters. They move by a sort of jump, and are seen frequently resorting to the surface to imbibe a fresh supply of air.



Gnat.

In their perfect state, they abound principally in the neighbourhood of water and marshy places. In Marshland, in Norfolk, the inhabitants are so annoyed by the gnats, that the higher classes, as in many hot climates, have recourse to a gauze-covering for their beds, to keep them off during the night. Spenser alludes to these insects in the following lines:—

As when a swarme of gnats at eventide
Out of the fennes of Allan doe arise,
Their murmuring small trumpets sownden wide,
Whiles in the air their clust'ring army flies,
That as a cloud doth seem to dim the skies;
Ne man nor beast may rest to take repast
For their sharp wounds and noyous injuries,
Till the fierce northern wind with blust'ring blast
Doth blow them quite away, and in the ocean cast.

207. The Mosquitoes are another species of the same family, which in many parts of the world interfere so much with our ease and comfort as to become one of the worst of pests, and a real misery of human life. They are very common in the woody and marshy parts of all hot countries, also abounding during their short summer throughout Norway, Lapland, and Finland. The Midge, so well known for its aerial dances, is the smallest species of the family.

208. Family *Tipulidæ* (or Water-spinners).—The most familiar species of the family is the *Harry Long-legs*. Many of the *Tipulidæ* in their larva state are very injurious to the roots of grass; others to the wheat-crops, by depositing their eggs in the centre of the corolla. They form a large tribe, subdivided by structure, but named from the places or substances they frequent: thus we have *Culiciform tipulæ*, *Terricole tipulæ*, *Gallicole tipulæ*, and *Floral tipulæ*.

209. Family *Tabanidæ* (or Gadflies) have highly organised mouths, the sucker being provided with six lancets. Many of them feed upon the blood of mammalia, and even of man himself. In the woods, in summer, they alight upon our face and hands, and put us to considerable pain. It is related that Messrs Kirby and Spence were frustrated in an entomological excursion by the prevalence of these insects, against the severe punctures of which they could find no protection. The Cleg (*T. pluvialis*) is the most common insect of the family.

210. Family *Cestridæ* (or Bot-flies) are all parasitic in some part of the body of mammalia. Most of them lay their eggs in the skins of animals, which they pierce for that purpose. This of course causes considerable pain, and the animals resort to many manœuvres to evade their tormentors. There are others, however, which deposit their eggs among the hair in situations where they can be licked off. These are swallowed, and hatched

in the stomach, to the inner membrane of which the larvæ attach themselves, producing the disease termed the *bots* in horses.

211. Family *Muscidæ*, or Flies (*Musca*, a fly).—The most familiar species are the House-fly (*M. domestica*), and the Meat-fly (*M. vomitoria*). The first of these are great torments—not that they bite, sting, or hurt, but that they buzz, tease, and swarm on everything eatable. The larvæ are bred in manure and carrion, and undergo their change in a very few days. Their purpose in nature is to consume various substances which would otherwise taint the atmosphere. It has long been a question how flies walk in situations where they have to contend against gravity. Some have asserted that it is effected by a vacuum produced by suckers attached to the end of the feet; others have suggested that the apparatus whereby they effect their hold is quite mechanical, accomplished by little claws, which they fix on asperities of the surface of bodies.

212. They generally fly in the same manner as a bird, with the back upwards. They have, however, the wonderful faculty of reversing their position, and of flying backwards, as when starting from a window and alighting on the ceiling.

213. How the buzzing sound is produced by the fly, has given rise to various conjectures. Rennie ascribes it to the action of the air on the edges of the wings at their origin, as with an Æolian harp-string, or to the friction of some internal organ on the roots of the wing nervures.

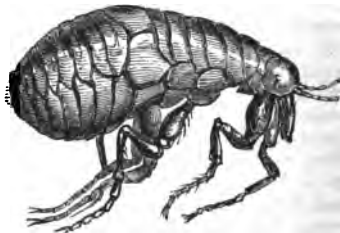
214. Next, how does a fly feed? The sole instrument it possesses for eating or drinking is its trunk or sucker—an instrument convenient enough for liquid food. But having no grinders, how does it effect the consumption of solid matter, such as sugar? The microscope has solved the difficulty, and shewn that the fly dissolves its food by a fluid passing through the sucker, and converting the sugar into a syrup. Few flies withstand the severity of winter; but such as do, remain in a dormant state, frequently in haystacks.

215. The *Blow-flies* are well known. They deposit their eggs on meat; but when the larvæ which are produced from these are about to change into the pupa state, they penetrate into the earth. These flies are the pests of the larder.

216. Family *Hippobosoidæ* (or Horse-flies).—The young of this family are remarkable for undergoing their states of larva and chrysalis within the abdomen of the parent, and being born as matured pupæ. The Horse-fly (*H. equina*), the type of the family, infests the horse; strebla, the bat; ornithobia and ornithomys are found upon a variety of birds; leptoteura, which has only rudimentary wings, inhabits the deer; and the mallophagi, which are destitute of wings, the sheep.

217. ORDER APTERA (Wingless Insects) includes a variety of creatures, most of which awaken unpleasant associations in our minds.

218. The family *Pulicoidæ* (named from the *Pulex*, or Common Flea) have the rudiments of wings, but, in point of fact, depend for locomotion on the extraordinary elasticity of their legs, enabling them to make an enormous spring. The power of the flea to penetrate the human skin, and feed on the blood, is only too well known. The creature lays from eight to twelve eggs, which are hatched in about five days, coming forth in a larva form, in which state the parent feeds them on particles of dried blood. A West Indian flea, of minuter size, named the *Chigoe*, is a dreadful pest to humanity, from its habit of depositing its eggs beneath the skin, where the larvæ come out and create severe sores, insomuch as often to cause the death of the nobler animal.



Flea magnified.

219. Family *Parasita* are typified by the common Louse, a creature justly regarded with loathing, because it never exists unless in connection with dirty habits. Man, the dog, sheep, and other animals, have each an appropriate parasite of this order. The *Parasita* are almost entirely destitute of eyes.



Podura villosa.

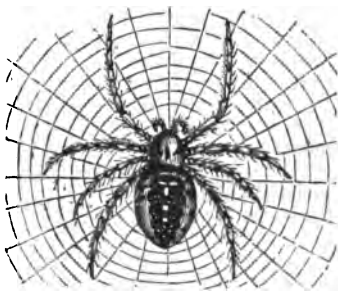
220. Family *Thysanoura* (or Spring-tails) are small insects possessing a forked tail for leaping. The *Podura villosa* is an example. Another is well known under the name of the *Sugar-louse*.

CLASS ARACHNIDA.

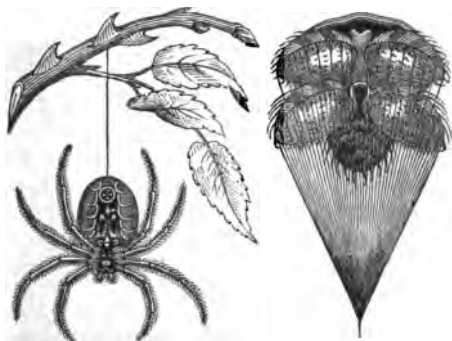
221. The Spiders and their allies, once considered as a branch of the *Insecta*, are now generally ranked as a distinct class. They may be defined as wingless, articulate animals, with jointed feet; the head confluent with the chest, and the body, consequently, consisting of only two segments. They have eight legs, and smooth or simple eyes. They possess no evident or distinct organ of hearing; yet it cannot be doubted that

they have a perception of sound. A very acute sense of touch resides in their tarsi and palpi.

222. Their instincts are very perfect, and even capable of striking development; and they require the full exercise of these faculties to circumvent their prey—as the latter are instinctively apprehensive of their natural enemies. Many of them weave a net for the purpose of intercepting the flies on which they expect to feed; others, which have not the means of doing this, roam forth or form pitfalls, and exercise their ingenuity in a variety of ways to obtain their provisions. The thread of which the spiders make their nets is a substance similar to the silk of the silk-worm and other caterpillars, but of a much finer quality. It proceeds from reservoirs into which it is secreted in the form of a viscid gum, and issues from the hinder part of the abdomen, where the thread is drawn through little teat-like protuberances.



Epeira Diadema.



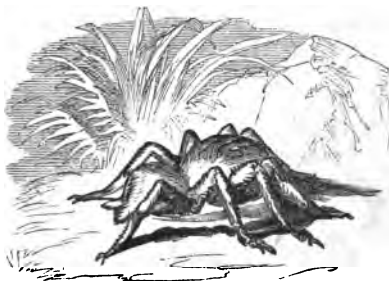
Spider, with thread-making organ magnified.

223. Nobody can have taken an early morning-walk, especially towards autumn, without having noticed the lines and webs of the spiders spread on hedge and fields. Spiders are oviparous, and their eggs are contained in a ball generally

larger than the body of the parent, which is popularly known as the egg. Spiders undergo no metamorphoses.

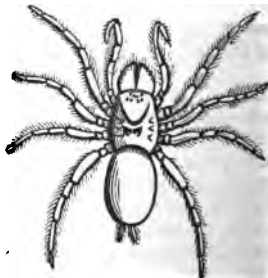
224. ORDER PULMONARIA (*pulmo*, a lung) includes the Arachnidans, which breathe by means of pulmonary sacs or lungs, contained in the under side of the body, and opening externally by stigmata, or small apertures.

225. Family *Araneidæ* are divided into two sections—Terrestrial and Aquatic. The former, inhabiting the earth, are either suspended in the air or cavities in rocks or trees, or they are affixed to plants, or else they occupy holes in the ground. To this section belongs the *Mygale*, the most powerful insect



Mygale.

of the order. When at rest, it covers a space of six or seven inches in diameter. Other species of *Mygale* burrow in the ground, and go under the name of *Mining Spiders*. They construct in dry situations subterranean cylindrical galleries, often two feet deep, and so tortuous that the traces of them are lost. These they line with a silken tube, forming at its entrance a movable lid, composed of silk and earth, attached to the silken lining by a sort of hinge. As the spider goes out and in, this door shuts of itself. Thus the creature lives like a robber in a cave, ready at all times to make attack, and comparatively safe from detection.



Mygale Fodiens.

226. The Aquatic *Araneidæ* dwell in the midst of the waters,

in a cell filled with air ; this consists of finely woven silk, in the form of a diving-bell, sometimes submerged, at others partly above the water, but always forming a dry and comfortable residence. From this their filaments are spread in the water to catch their prey.

227. Family *Phryneidæ* inhabit the intertropical regions of the Old and New World. Their habits are not well known ; but they are much feared in the countries where they live. They are of a large size, and malignant aspect.

228. Family *Scorpionidæ* (Scorpions) are easily known by their large maxillary palpi, which form a prehensile organ resembling the claw of a lobster. In addition to these powerful instruments, they have, at the extremity of their long tail, a poisonous sting, which they employ with deadly effect. Seizing



Scorpio Occitanus.

a little animal with the claws, they strike it with the sting, and then devour it. They are also fond of the eggs of spiders and insects. A small species inhabits this country ; but it is between the tropics that the Scorpions attain their greatest development.

229. ORDER TRACHEARIA (*τραχηία*, the windpipe) includes such spiders as breathe by tracheæ.

230. Family *Solpugidæ*.—The spiders of this family are usually covered with long hairs or spines, and are said to be venomous. They frequent sandy districts of hot countries. They run with great rapidity, holding up their heads as if to defend themselves. There are some minute species of this family natives of our country, which occur in moss.

231. Family *Phalangidæ* (*φάλαγγξ*, a compact mass.)—They are so called from the head, thorax, and abdomen being united. Their mandibles are very strong.

232. Family *Acaridae* (Mites).—Arachnidans, which have either a single jointed pincer, representing an antenna, or a suctorious mouth. They are all extremely minute, or even microscopic, but often present themselves to our view, running swiftly along damp furniture in dusky situations. They occur every-



Acarus Domesticus
(Mite) magnified.



a. Hydrachna Globulus; b. magnified;
c. young larva; d. pupa.

where — beneath stones, in moss, under the bark of trees, in flour, and dried provisions; but nowhere are more conspicuous than in the recesses of old cheese, which they will devour to the crust, if not prevented. Many persons, as is well known, consider the cheese acarus or mite a delicious morsel. Others are parasites upon the skin or in

the flesh of animals. Of the latter, the Itch insect is a remarkable example. They are naturally much flattened in form, but by suction become swelled out like blown bladders.

PROVINCE FOURTH.—VERTEBRATA.

233. THE last and highest division of the Animal Kingdom, is composed of animals in which the leading feature of distinction is the possession of a backbone or vertebral column. This peculiarity of structure is evidently designed not merely as the central part of a framework giving support to the figure, but as a case for the preservation of a nervous system superior to that of other animals, the skull, which may be considered as an expansion of its upper extremity, containing a large nervous mass, named the brain, while a tube running along the interior of the vertebræ is occupied by the spinal-cord, a continuation, as it were, of the brain, and the trunk, from which nerves branch off to all parts of the body. The general bony fabric, of which the vertebral column is the main or central part, is *internal*; that is, the muscular masses of the body are extended over it—an arrangement, it will be observed, contrary to any in the lower provinces of creation, where the hard and sustaining parts of the frame are always external. The skeleton usually comprehends four extremities, serving for progression, and occasionally for prehension or seizing, but subject to many variations, according to the element in which the animal lives, and the nature of its necessities. By virtue of their superior nervous system, the vertebrated animals stand decidedly above other provinces in intelligence. Another notable peculiarity, is their possession of red blood.

234. In the Vertebrata, there are four well-marked groups, denominated *classes*, rising in grades above each other, according to the character of their organisation, in this order: 1. Fishes; 2. Reptiles; 3. Birds; 4. Mammalia, or Suck-giving animals. The peculiarities on which the gradation is founded, will be adverted to in the introductory descriptions of the several classes.

CLASS FISHES.

235. The animals of this class are wholly aquatic, and are the only Vertebrata which, in their adult state, are formed for respiring beneath the surface of the water. They are furnished for this purpose with *branchiæ*, or gills—organs which we have already seen in the humbler provinces of the Animal Kingdom—being composed of a series of delicate filaments, through which the blood circulates, in order to be exposed to a needful chemical

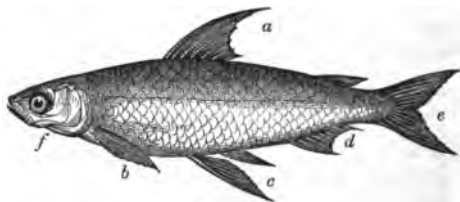
change by coming in contact with the air contained in the water. The lungs, by which the same function is performed in the higher vertebrata, do not exist in fishes; but in some a rudiment of this organ is found, in the form of a bag, serviceable in floating the animal, and called the *swimming-bladder*.

236. In fishes, the heart contains only two cavities; one of which receives the blood which returns from the system, the other propelling it through the gills, from which it is conveyed by the blood-vessels to the body at large. The blood in them, as in reptiles, is cold.

237. The individual vertebræ in the spinal column of the fish are hollowed on each side, with a bag of lubricating fluid between—an arrangement which gives great suppleness and agility of movement. In one large class, the bones never advance beyond a cartilaginous state. In the fishes generally, the limbs take the form of *fins*, the fore pair as what are called the *pectoral fins*, the hind pair as the *ventral fins*; and these are used rather as steering, than as propelling organs. The chief progressive power resides in the vertically formed tail, which the fish uses exactly in the way in which we employ a single oar in sculling along a boat. The surface of the body of fishes is usually covered with scales; and these are sometimes quite bony, and fitted closely together, especially where the internal skeleton is soft. In many species the gills are covered by a corneous plate, styled the *operculum*.

238. Fishes are very generally carnivorous, preying much on the weaker of their own kind; but some are herbivorous.

239. They are nearly all oviparous, and some of them exhibit an amazing degree of productiveness. The cod is reckoned as having a progeny of four millions at a time! The female fish deposits her eggs, or spawn, leaving to the male the duty of afterwards impregnating them.



Fish.

a, dorsal fin; *b*, pectoral fin of one side; *c*, ventral fins; *d*, anal fin; *e*, caudal fin, or tail; *f*, operculum.

240. In the above representation of a fish, we see,

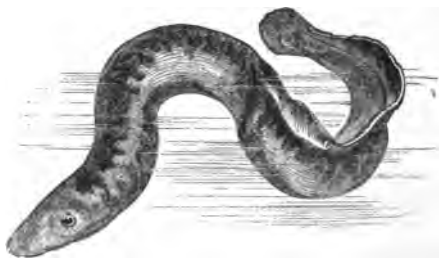
1st, the dorsal, anal, and caudal fins, prolongations of the spine, serviceable in balancing, steering, and progressing; 2d, the pectoral and ventral fins, four in number, answering to the four extremities of a quadruped, or the arms and legs of a human being, and likewise useful for motion. In most fishes, the ventral fins are placed far back, in the usual position of hind-legs; but in a few they are fixed far forwards, even anteriorly to the pectoral. These fins are composed of a set of bony or cartilaginous rays, answering to the bones of the hand and foot, and covered with a membrane. The bones representing the limbs, are short and hidden under the flesh. Thus the chief movement of the fins is, as it were, at the wrist and ankle-joints. In some species, these fins are absent, and the fish is said to be *apodal*. In other instances, the pectoral fins are enormously developed, like the wings of birds, and even enable the animal to rise out of the water, and for a short time skim over its surface.

241. The teeth of fishes are chiefly designed to serve as means of seizing prey; they are ordinarily conical in form, sharp at the points, and curved backwards. They are not only placed on the jaws, but also on the tongue, the palate, and other parts of the passage into the stomach. In some species, the jaws and palate are furnished with hard enamelled plates, set together like a pavement, and fitted to bruise and break down the hardest substances capable of affording nourishment. In this way the *sparus* is enabled to browse upon the branching coral, for the sake of the animal matter which its cells protect. Fishes thus furnished were more abundant in the early ages of creation.

242. The first division of the Fishes is into *Cartilaginous* and *Osseous*. It is remarkable that the former alone existed at first and for many ages, and the osseous did not make their appearance till the era of the chalk-formation. The whole class is arranged in nine orders, of which three belong to the *Cartilaginous*, and six to the *Osseous*.

243. The *Cartilaginous* Fishes, equivalent to the *Chondropterygii* of Cuvier, are most prominently marked by that character of the skeleton from which they take their name. The different parts of this frame, moreover, which in the osseous fishes are united by distinct joints, here frequently form one continuous piece. This is most remarkable in the head, which is composed of a single piece; in which, however, the principal parts found in the bony fishes may be distinguished by various ridges, furrows, and holes. In respect of the skeleton, this division of the fishes ranks below the other; but, on the other hand, it comprises some of the fishes of greatest intelligence, and while the osseous are all oviparous or egg-producing, many of these are viviparous or bring forth young alive.

244. ORDER CYCLOSTOMATA derive their name from their round mouth, composed of a fleshy lip supported by a cartilaginous ring, and adapted for adhering to prey and drawing nourishment therefrom by suction. In this group of fishes, which is certainly the lowest of the whole class, the spinal column has no distinct division into vertebræ, but is merely a cylindrical membraneous tube; the pectoral as well as ventral fins are absent; and the skin is soft and mucous, with scarcely a vestige of scales. This order contains but a single family. The *Lampreys* are the most allied to other fishes in their general organisation; they possess teeth within the ring, and with these they tear the bodies of the animals to which they attach



Lamprey.

themselves. There is a marine species two or three feet long, and other smaller ones which inhabit rivers. The *Myxine*, or Hag, is destitute of eyes, and is altogether of lower organisation than the lamprey; but the species that differs most in its general characters from the rest of the class, is the *Amphioxus*, or Lancelot. This is a very small animal, about an inch long, sometimes found lurking under stones in pools left by the ebbing tide. It is destitute of almost every one of the characters which have been mentioned as peculiar to vertebrated animals, and, nevertheless, can scarcely be classed anywhere else than with this family.

245. ORDER SELACHII.—A peculiarity of the Cyclostomata, that of having the gills so attached to the skin that the water cannot escape from their intervals except by holes in the surface, is shared by this order; the two being accordingly recognised as *Chondropterygii branchiis fixis*.

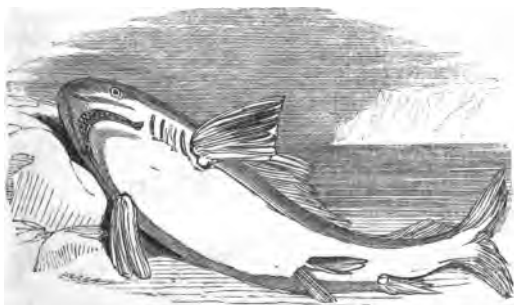
246. This order comprises one family—that of *Sharks* and *Rays*. They are distinguished from other fishes by many peculiarities: in several species, the young are produced alive,

the eggs being hatched within the body of the parent; and in others, the eggs are enclosed in a peculiar horny casing, which has often long tendril-like appendages, that coil around and attach them to other bodies. This is the case with the eggs of the common Dog-fish and Skate of our coast, and vulgarly



Dog-fish.

known as *sea-purses*. The sharks much resemble ordinary fishes in their form, having the gill-openings on the sides of the neck and the eyes on the sides of the head, in both of which respects the Rays differ from them. The dog-fish of the British coasts differs but slightly from the true sharks, and is, in its way, equally voracious.

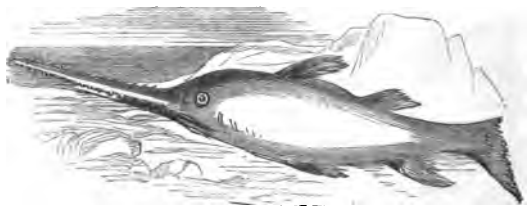


White Shark.

247. The White Shark is the most celebrated species of the tribe, being, from its size and voracity, the terror of mariners in the seas it inhabits. It frequents warm latitudes, but has occasionally visited the British shores. It has been known to

attain a length of thirty feet, and the opening of the jaws in the largest individuals is sufficient to admit with ease the body of a man. The mouth is placed on the under surface of the head, from which circumstance the fish cannot bite whilst in the act of swimming forwards, so that a dexterous person has been known to defend himself from its attack. The teeth are triangular and lancet-shaped, with acute points and edges, and form several rows; they are not fixed in the jaw itself, but in a muscular membrane, by which they are erected and made to project when in use, lying flat in the intervals. As the foremost are torn away, they are replaced with others, which are brought up from the rows behind. So acute and strong are these teeth, that they are used by many savage nations as the armature of their weapons. The shark, possessed of this powerful apparatus for attack, and having a very hard and rough skin for defence, with very great muscular power, is a match for almost any of the inhabitants of the ocean. The Blue Shark, which frequents the Mediterranean, is not unfrequently a source of great trouble to the fishermen of our coasts, on account of the injury which it does to their nets, and the loss of the fish they contain. The Fox Shark, or Thresher, is another of the second-rate species which occasionally makes its appearance on British coasts; it is distinguished by the size of its tail, and the use it makes of it as a weapon, both of offence and defence—whence its name.

248. A remarkable genus allied to the sharks is the *Zygana*, or Hammer-headed Shark, so named from the projection of the head at each side in the form of a double-headed hammer, with an eye in the middle of each extremity. The *Pristis*, or Saw-fish, is another interesting genus. Its general form and

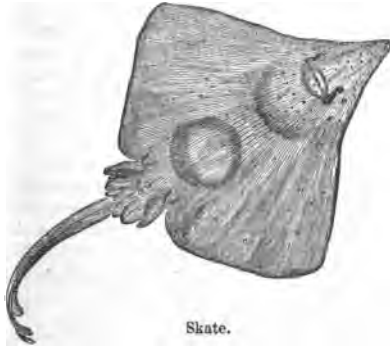


Saw-fish.

character are like those of the sharks, but the snout is extended like the blade of a sword, with strong and cutting tooth-like spines on both edges. With this formidable weapon the fish, which sometimes attains the length of from twelve to fifteen

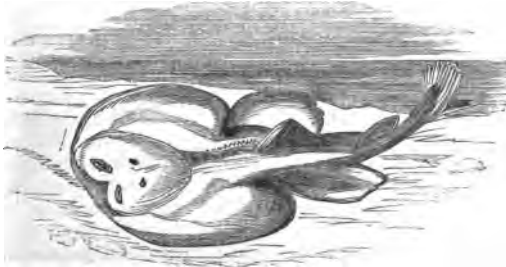
feet, will attack the largest whales, and inflict dreadful wounds. To the shark tribe also belongs the *Angel Fish* of our own coasts, which commonly grows to the length of seven or eight feet. Its appearance much belies its name, being, according to our ideas of beauty, one of the ugliest of fishes; but its flesh is by no means unpalatable.

249. The *Rays* are less numerous than the sharks, and abound rather in temperate than in tropical seas. They are characterised by the extreme horizontal flattening of the body. The two sides are spread out horizontally, and unite with the



Skate.

expanded and fleshy pectoral fins to form one continuous surface. The eyes are placed on the back or upper surface, whilst the mouth, nostrils, and gill-openings, are below. To this group belong the Rays and Skates, Thornbacks, and other

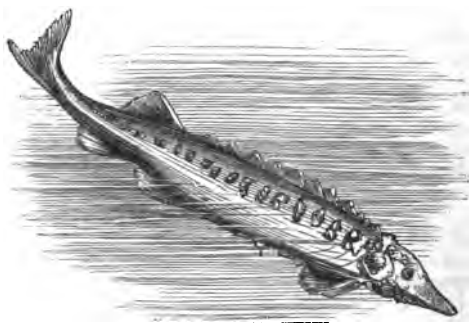


Torpedo.

species; but the most interesting of all is the Torpedo, or

Electric Ray, sometimes found on the Channel coast of England, but more abundantly in the Mediterranean. It possesses an electric apparatus, disposed in the space between the pectorals and the head and gills, and by which it can give a smart shock to any animal it touches. The flesh of the Rays is wholesome, and that of most species agreeable as food. The skin of some of them is employed in the arts for polishing, and from that of others shagreen is made.

250. ORDER CHONDROPTERYGII BRANCHIIS LIBERIS, deriving their appellation from having the gills attached by one edge only, and hanging in fringes, as in the osseous fishes, form but one family—the *Sturiones*, or Sturgeon tribe.



Sturgeon.

They are chiefly river-fish, and from their large size, vast numbers, and the quantity of food and other important products they afford, are extremely valuable to man. The common sturgeon of the British shores is about six feet long, and its flesh is somewhat like veal. The rivers falling into the Black and Caspian Seas, however, produce several other species, of which the largest not unfrequently attains the length of fifteen feet, one individual being recorded as having weighed 3000 pounds. The roe of the sturgeon furnishes the caviare, so much esteemed in Russia; and its air-bladder furnishes isinglass. The *Chimæra*—of which a northern species, known as the king of the herrings, often accompanies herring-shoals—is a genus intermediate between the

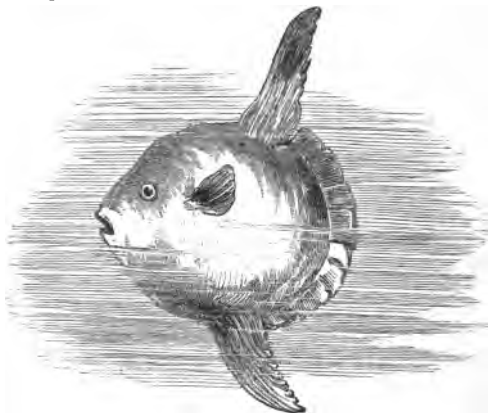
sturgeon and the sharks, having the gills fixed, but having only one external gill-opening, covered by the rudiment of an operculum; this leads, however, to five interior passages.

251. The Osseous Fishes are classified by Cuvier with a reference chiefly to characters of the fins and gills. Three orders are denominated *Malacopterygii*, as having the fin-rays soft, each bearing an additional designation according to the position or absence of the ventral fins. One order is designated as *Acanthopterygii*, from having the fin-rays spiny. Two other orders are distinguished by other peculiarities—*Lophobranchii*, or Tuft-gilled, and *Plectognathi*, or Jaw-soldered.

252. ORDER PLECTOGNATHI approaches the Cartilaginees in many points of organisation; principally, however, in the slow ossification of the skeleton, and the imperfect structure of the mouth. They derive their name from the union of the upper jaw to the skull; so that its motion is obtained, not from a distinct joint, but by the mere flexibility of the half-ossified cartilages. The gill-lid is concealed under the thick skin, with only a small opening; the ribs are scarcely developed; and there are no true ventral-fins. This order contains two families.

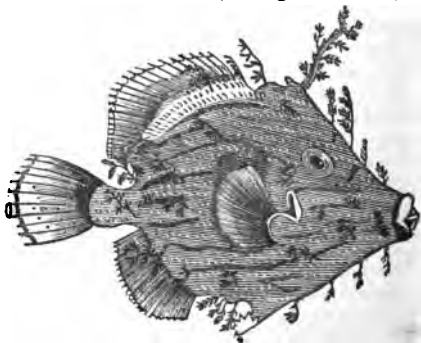
253. The *Gymnodontes* (Naked-toothed Fishes) are distinguished by having the jaws covered with a substance resembling ivory, arranged in small plates—which are reproduced as soon as destroyed by use—and really representing united teeth. They live on crustacea and sea-weed, and their flesh is not palatable. Some species are reputed to be poisonous, at least at particular seasons. The most remarkable species of this family are the spinous globe-fishes, *Diodon* and *Tetraodon*—their technical names being derived from the apparent division of their jaws into two and four tooth-like pieces respectively—which have the power of blowing themselves up like balloons, by filling with air a large sac which nearly surrounds the abdomen. When thus inflated, they roll over with the belly upwards, and lose all power of directing their course; but they are remarkably defended by spines over their whole surface, which are erected as they are inflated. They are mostly inhabitants of warm seas, but a specimen is occasionally drifted to our coasts. The *Sun-fish* has a body of somewhat similar form, but incapable of inflation; from the shortness of the tail, it looks like the anterior half of a fish cut in two in the middle. Some species attain an immense size. One, which is occasionally taken on the British

coast, has been known to weigh 300 pounds, and others are much larger.



Sun-fish.

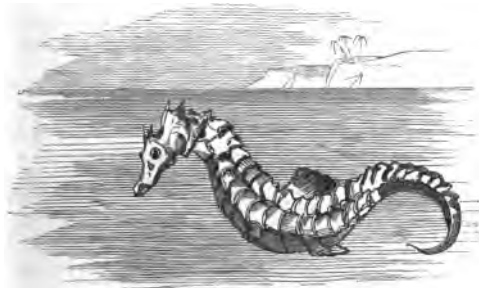
254. The second family, *Sclerodermi*, contains fishes which are remarkable for their very hard and granulated skins. They have a prolonged muzzle, with distinct teeth. Their skin is covered with scales in some species, and in others very rough, like a file, whence they are commonly termed *file-fishes*. They are principally inhabitants of warm seas, living near rocks, or on the surface of the water, their brilliant colours sparkling in the sunshine. The *Balistes*, or File-fishes, are generally remarkable for the appendages of various kinds attached to the surface of the body. One of the most curious species in this respect is the *B. pencilligerus*, whose body is covered with little branched stalks resembling



Balistes Pencilligerus.

aquatic plants. Not improbably, these may serve as baits for the animals upon which this fish preys, its body lying concealed among the rocks, whilst these curious little prolongations are gently agitated by the water. The *Ostracion*, or Trunk-fish, also belongs to this family. It is remarkable for having its head and body covered in such a manner with plates of bone, united together so as to form an inflexible cuirass, having openings for the tail, the fins, the mouth, and a small margin of the gill-cover. It thus bears no inconsiderable analogy to the tortoise tribes.

255. ORDER LOPHOBRANCHII is a very small one, containing but one family, of which the genera are few. Their appearance is very peculiar. The tufted gills are covered by a large operculum; but this is bound down by membranes on all sides, so that there is only one small hole for the water to escape. The body is covered, not with small scales, but with shields or plates, which often give it an angular form. In general, they are of small size, and almost without flesh. The *Syngnathus* possesses a long tubular snout. It is peculiar for the protection which it affords to its young, which resembles that provided in the marsupial mammalia. The eggs are conveyed into a sort of pouch under the body of the male, and are hatched there, the young fry afterwards finding their way out. Some of these are found in the British seas; as are also the *Hippocampi*, commonly called *sea-horses*, from the resem-

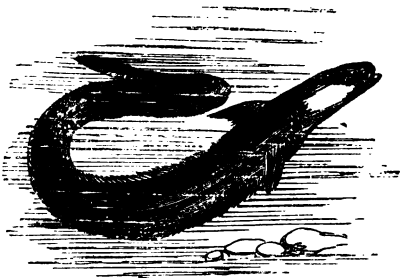


Sea-horse.

blance of the upper part of the body (especially when the dead specimen bends in drying) to the head and neck of a horse in miniature. Their tail is prehensile, and they climb or hold on to the stalks of marine plants by its means.

256. ORDER MALACOPTERYGII APODA (Soft-finned Fishes, destitute of ventral fins) form but one natural family—the *Muraenidae*, or Eel tribe. They are all lengthened in form, have the spine extremely flexible, the skin thick and soft, and the scales almost invisible. Many of them inhabit rivers, whilst others are exclusively marine. The eel is, strictly speaking, a fresh-water fish; but when living in rivers, or other collections of water communicating with the sea, it migrates towards the ocean in the autumn. During the winter, they bury themselves in the mud; and in the spring, those which have migrated usually return up the rivers, together with the young fry produced from the spawn, the number of which is enormous. Like trout, eels are much affected in appearance and quality by the waters they inhabit. They are very voracious, especially during the spring and summer months, not only devouring insects and small fry—on which last account they are often excluded from fish-ponds—but also attacking larger fish. As is well known, the eel can live for a little while out of the water, and is often found wriggling its way by night among damp grass, in pursuit of frogs, slugs, and other prey. It is enabled to do so by the smallness of the gill apertures, keeping the breathing organ moist—the only requisite, it appears, for prolonging the life of a fish out of its ordinary element. Occasionally they eat vegetable substances. By means of a long and capacious air-bladder, eels rise to various elevations in the water with great ease.

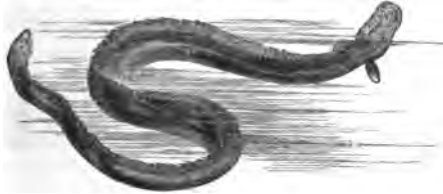
257. The Conger is a marine eel, frequenting the European



Conger Eel.

seas; it is one of the largest of the family, being from four to six feet long, and as thick as a man's leg. The *Muraena* is

destitute of pectorals as well as ventrals; one species of it was much esteemed by the ancients, who carefully fed it in ponds; and it is recorded that offending slaves were sometimes flung alive into the ponds for their supply. The *Gymnotus*, or Electric



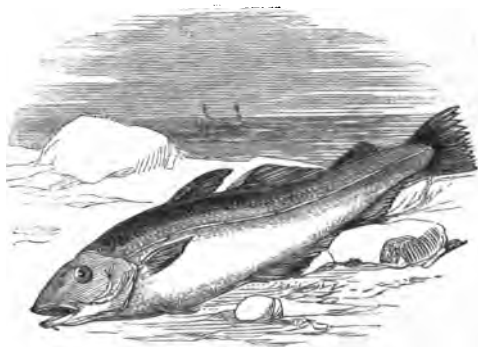
Electric Eel.

Eel, is a native of the South American rivers. It attains the length of five or six feet, and communicates shocks so powerful that men and horses have been stunned by them. This power seems voluntary, and can be sent in a particular direction, or even through the water, the fish in which are killed or stunned by its shocks. By giving these the animal is greatly exhausted, and requires rest and nourishment before it can renew them. The electric organ extends along the under side of the tail, occupying about half its thickness. It consists of parallel layers of membrane, joined by numerous transverse folds, so that a number of canals or cells are formed, which are filled with gelatinous matter. The apparatus is largely supplied with nerves. Some species of this family, which is commonly known under the name of *Anguilliform*, or Eel-like Fishes, approach very closely to the lower reptiles in the structure of the air-bladder or lung; and in these the external opening of the gills is usually very small.

258. ORDER MALACOPTERYGII SUB-BRACHIATA derive their subordinate name from having the ventral fins brought forwards beneath, or even in advance of the pectoral. They form three families.

259. Family *Gadidae* (the Cod tribe) are easily known by the softness of all their fins, and by having the ventrals inserted under the throat, and pointed. The greater number live in cold or temperate seas, and furnish a most important article of food, their flesh being wholesome, easy of digestion, and agreeable to the palate, and their numbers—owing to their extraordinary reproductive power—extremely abundant. The

Cod is nearly the largest of the family, but is usually surpassed by the Ling, which is commonly from three to four feet long: both these are especially valuable for their palatableness when

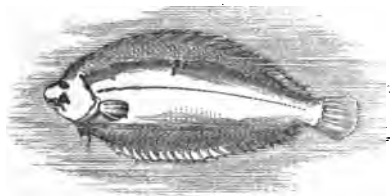


The Cod.

salted. The Haddock is a smaller species, nearly allied to the cod; for eating in the fresh state, it is perhaps the most delicate of the whole family. Many other species are useful to man, occurring in large numbers in particular localities. Such are the Whiting, the Coal-fish, the Pollock, the Haak (of which some species frequent high southern latitudes), the Burbot, or Eel-pout (which ascends rivers), the Rockling, and many others. Besides their use as food, these fish are valuable on account of the oil obtained from their large livers, which is very serviceable in the arts and in medicine.

260. The second family is that of *Pleuronectidæ* (the Flat-fish, or Flounder tribe).—The form of these fish is peculiar, not only for the extreme flattening of the body, but for its deficiency in symmetry. The two flat surfaces—one of which, in the ordinary position of the fish during life, is above, and the other below—are in reality the two *sides* of the fish, differing in several important respects. Both the eyes are placed on the upper side; and its colour is usually much deeper than the other. The body, from the head backwards, partakes a little of the same peculiarity. The two sides of the mouth are not equal, and the pectoral fins rarely so. On the other hand, the dorsal fin, which runs along one of the lateral edges, corresponds with the anal, which occupies the other, and with which the ventrals are sometimes united; so that, when we

look at the fish in its usual position, its body appears more symmetrical than it really is. These fishes are destitute of air-bladders, and they frequent the bottom of the sea, from which they seldom rise far. The colour of their upper surface usually corresponds closely with that of the ground on which they lie, and thus they escape the observation of their enemies, and are unnoticed by the small fishes on which they prey. Individuals are occasionally found, however, in which both sides are alike; these are called *doubles*: it is usually the dark side which is doubled. The fishes of this family are found along the shores of almost all countries, and are, generally speaking, wholesome and agreeable as food. The form and aspect of the different species exhibit little variation. The Flounder, Turbot, Brill, Plaice, Dab, and Sole are the chief



Sole.

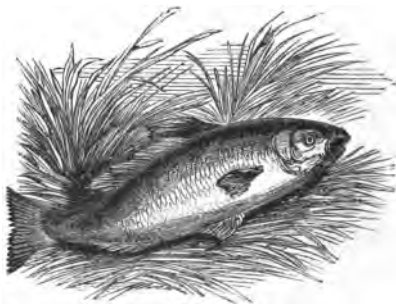
species of our own coasts. The Halibut is a very large species, sometimes attaining the length of six or seven feet—frequently taken in the British seas. Other species inhabit the Mediterranean.

261. The *Discoboli*, so named from having their ventral fins formed into a sucker or disk, are the last family of this order. By this curious provision, the fish have the power of attaching themselves to rocks and other hard substances, and thus to remain and find their food in situations where every other species would be swept away by the current of water. Several species are found on the British coasts, but they are mostly small; the most considerable is the Lump-fish, which is occasionally eaten. The *Echeneis remora*, or common Sucking-fish, is placed under this family, but probably ought to constitute a distinct group, since its disk is not formed by the ventral fins, but by a series of thin and movable cartilaginous plates fixed to the head, by means of which the animal can attach itself to any kind of surface. It seems to prefer bodies in motion; and is not unfrequently found adhering to larger fish, and to the bottoms of vessels, whose course it was once

absurdly believed capable of arresting. It is abundant in the Mediterranean.

262. ORDER MALACOPTERYGII ABDOMINALES consists of soft-finned fishes, having the ventrals attached to the abdomen, behind the pectorals. It is a very numerous order, including the greater number of the fresh-water fishes. There are five families.

263. Family *Cyprinidae* (Carp tribe) are all fresh-water



Carp.

fishes. They have the mouth shallow, the jaws feeble, and very often without teeth; but the pharynx is strongly toothed. They are among the least carnivorous of fishes, feeding chiefly on seeds, the roots of plants, and decomposing vegetable matter. The common Carp is imported into England from the warmer parts of Europe; it thrives better in ponds or lakes than in rivers; it feeds on insects and worms, as well as on vegetables; and it is very tenacious of life, so that it is easily transported from place to place. The Barbel is an allied species of considerable size, sometimes growing to the length of three feet. It frequents the sluggish parts of the Thames and its tributaries, and is said to plough up the mud with its nose, which, setting various minute animals adrift in the water, attracts the small fishes on which it feeds. The Cobitis or Loche, is another British species, which is interesting in some of its habits. It inhabits the mud of stagnant waters, and can subsist a long time after the water has been dried up or covered with ice. When the weather is stormy, the loches rise to the surface of the water, and keep it in a state of agitation by their motion; and, when cold, they bury themselves in the mud. They have been observed to

swallow atmospheric air at the surface, and to discharge it at the vent in the form of carbonic acid. On account of their lurking habits, however, they are not often seen in their natural haunts. The *Anableps*, a genus allied to the cobitis, has a remarkable peculiarity of structure in the eye, each cornea and iris being divided by transverse bands, so as to give the fish the appearance of having four eyes. The object of this conformation is unknown. The fish inhabits the rivers of Guiana.

264. The *Esocidæ* (Pike tribe), the most voracious of the



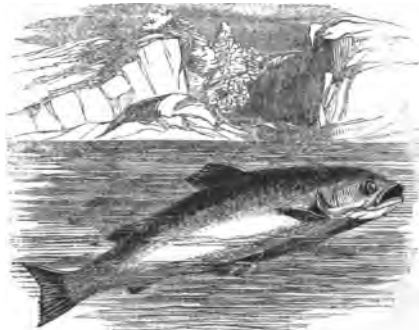
Pike.

fresh-water fishes, are distinguished by the absence of fatty matter in the dorsal fin (which exists in the salmon tribe), and by the position of this opposite to the anal fin. The Pike is very destructive to the smaller fishes in the ponds and rivers in which it exists, and occasionally attains a considerable size, weighing sometimes thirty or forty pounds. The *Gar-fish*, or *Sea-pike*, is an allied species, frequenting the British shores, and stretching into the Arctic regions. Some of this kind have been known to attain the length of eight feet, and to bite very severely; hence they may be considered as the sharks of northern seas. The *Mackerel-pike*, or *Saury*, is another British fish of this family; it is gregarious in its habits, and is followed and preyed upon by porpoises, tunnies, and other large fish. To this family belongs the most common of the flying-fish, though it is not the only one which deserves the title. The *Exocoætus* is at once distinguished from the rest of the family by the immense size of its pectoral fins, by the impulse of which upon the water it is enabled to rise into the air; but it can scarcely be said to *fly*, since it is able to do little more than partially sustain itself without again dipping into the water. The fish appears to have been gifted with

this power, to enable it to escape from the pursuit of a certain voracious fish, the *Coryphæna*; but in avoiding one enemy, it puts itself in the way of others, for predaceous birds watch it, and seize it as it rises into the air. They furnish an excellent article of food, and are very abundant in the neighbourhood of some tropical islands; individuals have occasionally appeared as stragglers on our own coasts.

265. The *Siluridæ* are distinguished from all the rest of the order by the want of true scales; having only a naked skin, or large bony plates. The fishes of the genus *Silurus* inhabit the rivers of warm countries; they have a strong spine in front of the dorsal fin, which can be laid flat on the shoulder, or perpendicularly erected so as to become a formidable weapon; and the ragged wounds inflicted by it are reputed (but probably erroneously) to be poisonous. One species, belonging to the sub-genus *Malapterurus*, an inhabitant of the Nile and of the rivers of Central Africa, has electric properties, similar to those of the torpedo and gymnotus.

266. The *Salmonidæ* (Salmons and Trouts) are very extensively, indeed almost universally, diffused over the globe; some of them being confined to fresh water, and others passing a part of their lives in the sea, but resorting to rivers to deposit their eggs. They are distinguished by the fatty deposition in the dorsal fin, from part of which the spines often disappear. All of this family are clouded with dusky patches when young, and many remain permanently spotted. The flesh of most of them is esteemed as food. The Salmon inhabits the seas of compara-

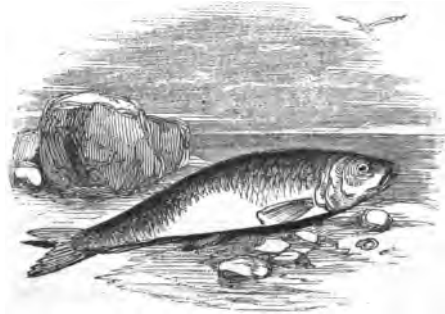


Salmon.

tively cold regions, ascending the rivers for the purpose of spawning, at seasons varying with the climate. The efforts

which they make to overcome difficulties in the ascent are very great: they will not only swim against powerful streams, but will leap up cascades of considerable elevation, and find their way to the brooks and small lakes of lofty mountains. After this operation is accomplished, they return to the sea, followed by the young fish. These, in their turn, ascend the rivers for the same purpose, and are understood to resort to those in which they were produced. The Trout appears to vary much in size and colour, according to the climate and other conditions of its residence, so that it is difficult to distinguish species from mere varieties. The growth of this fish is wonderfully rapid, individuals previously marked having been found, when recaptured three weeks afterwards, to have grown several pounds heavier. It is now beyond doubt that the *Par* is the young of the salmon. The darker the retreat of the trout, the darker it gets in colour. Besides these may be mentioned, as belonging to the same family, the *Smelt*, which is sometimes found abundantly, but locally, in the estuaries of British rivers; and the *Capelin*, which is employed on the shores of Newfoundland as a bait for cod, and is sometimes taken in such quantities as to serve as manure for the land. A large species of this family, the *Serrasalmus*, inhabiting the American rivers, seems possessed of an unusual degree of ferocity, pursuing ducks, and even men whilst bathing, and wounding them severely with its teeth. Most of the family exhibit great voracity.

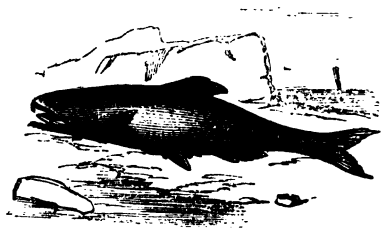
267. The *Clupeidæ* (Herring tribe) is one of the most



Herring.

important families in the whole class, for the amount of food it

supplies to man. The fishes belonging to it resemble the Salmonidæ in many characters, but differ in having no fatty matter in the dorsal fin. They chiefly inhabit the seas of the temperate zone. The Herring, which periodically visits our shores in such immense shoals, was formerly supposed to migrate from the Arctic seas; but this is now ascertained to be a mistake, the fish being almost unknown there, and often appearing on the southern coast of Britain before the northern. The fact is rather that the herring, like the mackerel and many other fish, usually lives in the open ocean, and resorts to the nearest coast to deposit its spawn. There are many well-known species, differing but little from the herring, which frequent separate localities. Thus, the *Pilchard* is caught especially on the coast of Cornwall, and other shores to the southward of those on which the herring most abounds. The *Sardine* is taken on the west coast of France, and in the Mediterranean, where the herring never appears. The *Sprat*, *Whitebait*, *Shad*, and other British species, belong to the same family, as does also the *Anchovy*, well known for its rich and



Anchovy.

peculiar flavour, which is abundant in the Mediterranean. Other species inhabit the American, African, and Indian seas and rivers, but they are less abundant than those already mentioned.

268. ORDER ACANTHOPTERYGII (Spiny-finned Fishes) are divided by Cuvier into fifteen families.

269. *Percidæ* (the Perch tribe).—These are very numerous in the waters of all warm climates, some species inhabiting the rivers, and others the open sea. Their bodies are oblong, and covered with hard or rough scales; and the gill-covers are toothed at the margin. They are mostly *thoracic*, or have the ventral fins under the pectoral. Some, however, are *jugal*—

that is, have the ventral fins placed upon the throat, further forwards than the pectorals; and some are *abdominal*. Their teeth are very minute, and set close together in numerous rows. Their flesh is, in general, agreeable and wholesome. This family includes all the fish known as perches, of



Perch.

which some species are found in almost all the rivers in the world, and a large number of marine fishes used as food on different shores. Some of the most remarkable are—the *Trachinus*, or Weaver, which has a very prolonged and sharp dorsal spine, capable of inflicting a severe injury, and which fishermen believe, but erroneously, to have poisonous properties; the *Uranoscopus*, or Star-gazer—so called from the position of the eyes upon the top of the nearly cubical head—which lies concealed in the mud, and attracts its prey by a filament which it protrudes from its mouth, and which serves as a bait to small fishes; the *Polynemus* (many fillets), whose pectoral fins are prolonged on each side into threads twice as long as the body, and of which a species inhabiting the Ganges, termed the Mango-fish, is esteemed the most delicious in India; the *Sphyræna*, or Sea-pike, to be distinguished from the common pike, of which one tropical species, the *Barracuda*, is much dreaded for its size and voracity; the *Red Mullet*s, or, more properly, *Surmullet*s, of the British seas; and many others.

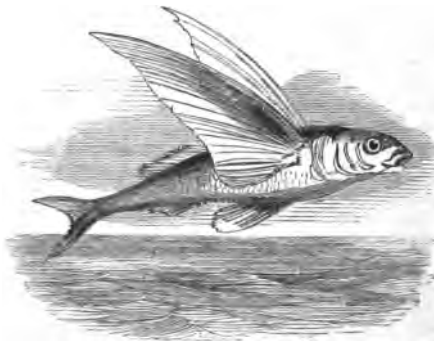
270. *Triglidae* (the Gurnard tribe).—These bear a general resemblance to the perches, but have the head peculiarly armed with spines or hard scaly plates. In several species the pectoral fins are very much extended; but in none, except the flying-fish, are they sufficiently powerful to raise the animal out of the water. Many species of this tribe are found in the temperate seas, which, though inferior in flavour to the surmullet, supply wholesome and agreeable food. To this family belong the

Gurnards and Sticklebacks of our own coast; the *Scorpena*, a gregarious fish, living among the rocks; the *Sebastes*, or Norway haddock, rather a large species, the spines of which



Gurnard.

are used by the Greenlanders as needles; and a large number of others. The most interesting of all is the *Dactylopterus*, or Flying-fish. This has a kind of supplementary pectoral fin on each side, formed of a membrane stretched over finger-like processes, which in the gurnards are unconnected. By the impulse of these on the surface of the water, the flying-fish



Flying-fish.

can rise several feet into the air, and suspend themselves above the surface for a few seconds, often skimming lightly over it for a considerable distance. They are gregarious; and it is when a shoal of them is chased by the *Coryphæna*—commonly, but erroneously, termed *dolphin*—or some similar

enemy, that the most remarkable leaps are taken. They not unfrequently fall upon the deck of vessels that happen to be passing amongst them. The finger-like processes are usually prolonged beyond the fins, and appear to possess an amount of sensibility unusual in such parts.

271. The *Sciænidae* (Maigre family) have a general resemblance to the perches, but differ from them in the absence of teeth from the palate, and some other particulars. They principally belong to tropical seas, a few inhabiting the Mediterranean.

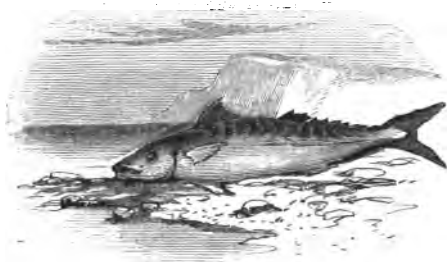
272. The *Sparidae* (Sea-bream tribe) resemble the last in general form, but have no spines on the gill-covers. Some of these, including the genus *Sparus*, already mentioned as grinding down the stony corals, have the sides of the jaws covered with round flat teeth, resembling a pavement. Others have teeth with cutting edges.

273. Another small family, *Menidae*, differs from the last chiefly in the great extensibility of the upper jaw.

274. The next family, *Squamipennes*, is so named because the soft and even the spinous parts of their dorsal fins are so covered with scales as not to be distinguished from the rest of their bodies. The most interesting genus is the *Chatodon*, of which several species, remarkable for the beauty of their colours, abound in tropical seas. One of these, the *C. rostratus*, which has a very prolonged snout, has the faculty of shooting insects with drops of water projected from the mouth, and it then seizes them as they fall. This power is the more extraordinary, as, according to the laws of the refraction of light, the place of the insect will appear to the fish different from the reality—the rays passing from a rarer to a denser medium; and the drop must not, therefore, be projected in the line in which the insect *appears* to be, but somewhat below it. This little fish, which is a native of India, is often kept in glass-vases by the residents there, as gold-fish are in this country, for the purpose of affording amusement by its dexterity.

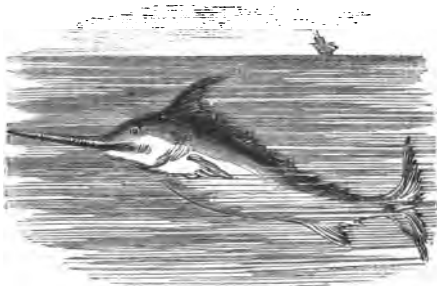
275. The next family, *Scomberidae* (the Mackerel tribe) is one of very great importance to man. It comprises a large number of genera, a vast collection of species, and numberless individuals. The aspect of the common Mackerel, with its spindle-shaped, beautifully-coloured, smooth, and small-scaled body, is well known. It very rapidly dies out of water, and soon becomes tainted. The Mackerel has been supposed to be a migratory fish, on account of its appearing on our shores in immense shoals at particular epochs. But it may be caught all the year round on our coasts, which shews that it does not wholly desert them, as is done by the really migrating tribes.

The fact is, that it passes most of the year in the open sea, and that its object in approaching the shore is to deposit its spawn ; after which, those that have escaped being entrapped by the ingenuity of man, return to their former quarters. The extent



Mackerel.

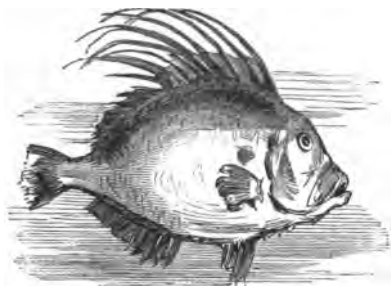
and importance of the mackerel-fishery of Britain, especially in the south and east, are well known. The Tunny is an allied species, attaining a much greater size, and also valuable as an article of food. It frequents the Mediterranean, and is occasionally seen on our own shores. It sometimes attains the length of fifteen or even eighteen feet. To this order belongs also the *Xiphias*, or Sword-fish, distinguished by its long pointed



Sword-fish.

beak. This is a most powerful offensive weapon, and with it this fish attacks the largest inhabitants of the ocean. By its high dorsal fin and expanded tail, it is able to impel itself forwards with great force ; and when attacking a large animal,

it makes a violent dart against it, quite transfixing it with its sword. It has been known in this manner to drive its beak into the timbers of a ship, and, not being able to withdraw it, to break it off, and leave it. The sword-fish abounds in the Mediterranean, but is less frequent in the Atlantic. It is very palatable as food, and often attains the length of fifteen feet. The *Dory*, of which one species is highly prized by epicures, is



Dory.

another fish of the same family. It is remarkable for the filamentary prolongations from its dorsal fins. And, lastly, may be mentioned the *Coryphæna*, commonly known as the Dolphin. This is a large and splendidly coloured fish, which darts through the water like a radiant meteor, exhibiting an extraordinary play of colours when brilliantly illuminated. It has long been celebrated for its change of colour when dying; a peculiarity which belongs to many other kinds of fish. It swims with great rapidity, and is very voracious, committing great havoc among the flying-fish and others of like size. The influence of light on the colour of animals is remarkably shewn in the far superior brightness of the Indian Scomberidæ, when contrasted with the blackish hue of those of northern seas.

276. The family of *Tænidæ* (Ribbon-shaped Fishes) is a small one allied to the Scomberidæ, differing chiefly from it in the remarkable lateral flattening of the body. Few species are known on our shores; one of the largest, *Lepidopus argyreus*, the Scabbard-fish, occasionally appears on these coasts; it is about five feet long, swims with extreme rapidity, and often with the head above water. Allied to this is the *Trichiurus*, some of the Indian species of which have been said to possess electric properties; but this is doubtful.

277. The *Theutyes* (Lancet-fish tribe) are another small family allied to the mackerels, but are peculiar for their

cutting spines on each side of the tail, and a horizontal spine before the dorsal fin. They have only a single row of teeth, and feed chiefly on marine plants. Their powerful lancet-shaped spines are used very dexterously as weapons of defence; and in this respect may be compared to the horns of the Ruminantia.

278. The fishes of the tenth family, *Pharynginae labyrinthiformæ*, are characterised by a very peculiar structure, from which they derive their designation. The membranes of the pharynx, or back of the mouth, are divided into small irregular leaves, containing cells among them, which the fish can at pleasure fill with water; and by ejecting a portion of this water it moistens its gills, and may thus continue its respiration out of its proper element. By means of this apparatus, which resembles that possessed by the land-crabs, these fishes are enabled to quit the pool or rivulet which constitutes their usual element, and move to a considerable distance over land. Such a provision is especially desirable in tropical climates, where shallow lakes are often dried up by a continued drought, and their inhabitants must perish if not enabled to migrate. The people of India, often witnessing the appearance of these fishes where they were known not to exist, believe that they fall from heaven. Some of them are able not only to traverse plain grounds, but can climb steep banks, or even trees, in the course of their journeys. The most curious is the *Anabas*, commonly known as the Climbing-perch of Tranquebar, which climbs bushes and trees in search of its prey, a species of land-crab, by means of the spines on its back and gill-covers.

279. The *Mugilidæ* (Mullet tribe) are lengthened and often nearly cylindrical fishes, with a somewhat projecting snout, and a very small mouth placed beneath it. They are gregarious in their habits, frequenting the mouths of rivers in large troops, and constantly leaping up out of the water. There are several species found in European seas, of which the flesh is much esteemed. That best known on the British coast is the *Mugil chelo*, or Thick-lipped Gray Mullet. The fishes of this family feed in part upon crabs and other small crustacea.

280. The members of the family *Gobioidæ* (or Goby tribe) are known by the thinness and flexibility of their dorsal spines. Many of them are remarkable for producing their young alive, the eggs being hatched within the body of the parent. This is the case with the Blenny, of which several species frequent the British shores, living in small troops among the rocks. They are remarkably tenacious of life, and are capable of being kept a good many days in moist grass or moss, but they are of little value as articles of food. One of the most interesting

species of this family is the *Anarrichas lupus*, or Sea-wolf. It inhabits the northern seas, and is often met with on our shores, attaining the length of six or seven feet. It is very formidable in aspect, and the size of its teeth, with the colours and peculiar physiognomy of its head, remind the observer of the carnivorous mammalia. Its manners accord with its aspect, for it is remarkably strong, very active, and equally ready to defend itself or to attack an enemy. It often enters the fishermen's nets, for the purpose of plundering them of the entangled fish; and when the fishermen attack it, and it cannot escape, it fights like a lion. After receiving very severe injuries, and seeming dead, it will often inflict a sharp bite if incautiously irritated. It is seldom eaten in this country through dislike to its appearance, but it furnishes light and wholesome food. The Arctic seas appear to be its appropriate home, and there it attains a larger size than further south; it is very valuable to the Icelanders, who salt its flesh for food, and employ its skin as shagreen. The true Gobies have the ventral fins placed far forwards, and united at their bases; they are chiefly remarkable for the *nest* which they construct among the sea-weed for the protection of their young. They prefer a clayey bottom, in which they excavate canals, and in these they pass the winter.

281. The next family, *Pectorales pedunculati*, derives its name from the peculiar structure of the pectoral fins, which have a kind of wrist formed by the elongation of the bones to which they are attached. This conformation gives these fishes a very strange appearance, and enables them to leap suddenly up in the water in pursuit of their prey, and even to leap over the mud. In many of them the skeleton is demi-cartilaginous. One of the most curious is the *Lophius*, or Fishing-frog, of the British seas, which is met with chiefly on muddy shores. It derives its name in part from its wide gaping mouth, and in part from the peculiar manner in which it angles for its prey. It has some curious appendages to its head, which terminate in long, round, and rather brilliant filaments, having a resemblance to worms. The animal lurks in the mud, and puts these appendages in vibration; they are mistaken for worms by small fishes, which they attract, and these are gulped down the capacious maw of the lophius. To such an extent is this voracity carried, that the *angler* (as it is sometimes called) is often an article of value for the fish which it has in its stomach, although its own flesh is worth but little! There is an allied genus, the *Chironectes*, of which a species abounds on the north coast of Australia. When the tide ebbs far back in the dry season, these frog-fishes are so abundant, and capable of taking

such vigorous leaps, that those who have visited these places have taken them at first sight for birds. The fishes of this genus can inflate their large stomachs with air, in the manner of the tetraodonts.

282. The *Labridæ* (Wrasse, or Rock-fish tribe) are easily known by the thickness and fleshiness of their lips, whence their name. Those of the genus *Labrus* are known on the British shores by the name of *old wives*; some of them vary considerably in their colour. They frequent deep pools among the rocks, hiding themselves in sea-weed, and feeding mostly upon crustacea. This family contains a large number of species, chiefly inhabiting tropical seas, and remarkable for the beauty of their colours, but they are usually of small or moderate size; their habits are little known, and they are of but slight direct importance to man. Some of them have received the name of *parrot-fishes*, on account of the brilliancy of their markings and the form of their jaws.

283. The last family of the Acanthopterygii consists of the *Fistulariæ* (Pipe-mouthed Fishes), at once recognised by the very prolonged muzzle. Some species have the bodies also long and cylindrical, whilst in others it is oval and compressed. They are chiefly found in warm latitudes; but one species, *Centriscus scolopax*, Sea-snipe, Sea-trumpet, or Bellows-fish, is occasionally found on the Cornish coast, as a straggler from the Mediterranean.

CLASS REPTILES.

284. The class of vertebrated animals next above fishes is distinguished by a name expressing *creeping habits* (*repto*, I creep). Like fishes, the animals of this class are oviparous, or produced by eggs, and many of them are covered with plates and scales. They are also, like fishes, cold blooded. They are superior, however, to fishes, in having lungs, and breathing the atmosphere. While the fishes possess a heart of only *two* cavities, that of the reptile consists of *three*, which may be considered as, in one sense, an imperfect form of the organ; and the consequence is, that only a portion of the blood, on returning from the veins, is propelled through the lungs, the greater part passing again into the circulation without being aerated. Hence the coldness of the blood of the reptile, and hence it is that animals of this class are in general sluggish in their digestive powers, and also in locomotion. The vitality of the reptile may be said to be low, and it is not surprising that many of them are capable, under a low temperature, of falling

into a state of torpor, during which the whole of the animal functions are suspended.

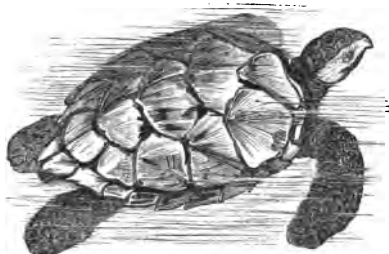
285. There are differences among naturalists as to the classification of Reptiles; but latterly the tendency has been to consider the Tortoise, the Lizard, the Serpent, and the Frog as the four leading types; and, accordingly, the whole may be ranked in four orders—*Chelonia*, *Sauria*, *Ophidia*, and *Batrachia*.

286. ORDER CHELONIA are distinguished by a peculiar form of the skeleton, having evidently in view the protection of the animal. In typical species, the ribs are expanded so as to form but one bony plate, having no flesh outside, but covered with horny plates, secreted from the skin like hair or nails; the breastbone being similarly expanded into a plate covering the whole of the lower surface, and joining the edges of the upper plate; so that the animal may be said to be sheltered in a box formed of its bones. Within this box, the upper plate of which is named the *carapace*, and the lower the *plastron*, the animal can even withdraw its head and feet, and thus set most enemies at defiance. When it is observed that the Chelonia are in general without teeth, claws, or other sharp instruments, and are for the most part herbivorous and of gentle dispositions, it seems not inappropriate that they should be provided with such a means of defence.

287. In the Chelonia, the jaws are covered with a horny substance, resembling that of the bills of birds; but their surfaces are usually rounded, so as to be more adapted to bruise than to bite. In those designed to live in the water, the extremities take the form of paddles.

288. The family *Cheloniæ* (Turtles) are designed for a sea-life, feeding chiefly on marine-plants, and only coming on land to deposit their eggs, which they do thrice a year, laying about a hundred at a time. They are generally large animals, sometimes exceeding five feet in length, and 800 pounds in weight. The bones and plates are not so closely joined as in land-tortoises; consequently, their bodies possess a certain degree of flexibility. The *Chelone midas* (Green, or Edible Turtle) is noted for the delicious food which it yields. Animals of this species may be seen in the tropical seas of America, browsing in large flocks on the plants growing on the bottom, only ascending to the surface now and then to breathe. They migrate hundreds of leagues to lonely shores, where there are loose sands fitted to hatch their eggs. Ascension Island, in the South Atlantic Ocean, is noted as one of their favourite retreats.

289. The *Chelone imbricata* (Hawk's-bill Turtle) is a smaller species, having a horny and pointed muzzle, fitted to cut as well as bruise. It is remarkable on account of the horny



The Hawk's-bill Turtle.

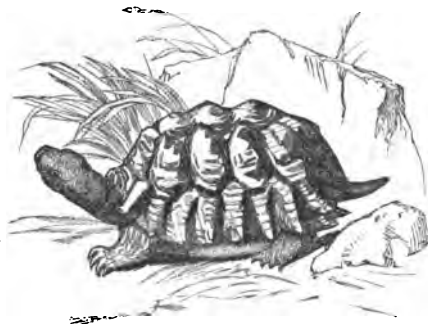
plates covering its carapace, which, being thicker and stronger than usual, and beautifully coloured, furnish a material for combs and other useful articles. About twelve pounds of *tortoise-shell*, as the substance is called, is yielded by each full-grown animal. These plates do not join at the edges, like those of land-tortoises, but overlap each other, like the scales of other reptiles.

290. The *Chelone caretta* (Loggerhead Turtle) has a strong mouth with sharp jaws, and feeds upon various marine animals, as well as plants. Its carapace is covered, not by plates, but by a thick leathery skin. This animal (called also *Sphargis*) inhabits the Mediterranean, as well as the Atlantic and Pacific Oceans.

291. The family *Emydæ* (Fresh-water Turtles, or Mud Tortoises) are comparatively small animals, distinguished by the form of their feet, which end in toes furnished with claws, but nevertheless, being webbed, are useful for swimming. They inhabit the rivers of the south and east of Europe. To this group belongs the *Snapping Turtle* of America, a comparatively destructive and powerful animal, possessed of sharp claws and a long tail, and capable of biting through a stick half an inch in diameter. It lives upon small animals in and out of the water.

292. The family *Testudinidæ* (Land Tortoises) have their armour thicker and stronger, in proportion to their size, than the aquatic species. The legs are short, and the feet clubby, shaped somewhat like those of the elephant, and adapted for walking on firm ground only, as the surface they present is very small. The animals are inoffensive, living chiefly upon

roots and vegetables, and the insects which infest them. They dig burrows for themselves in which to sleep over the winter.



Tortoise.

Some individuals of the family have been known to live to an age extending over four or five human generations.

293. There is a genus differing from the above, and named the *Trionyx*, from having three of the toes on each foot furnished with claws. The carapace and plastron are not completely ossified, and are covered with a soft skin. The animal is highly serviceable in the Nile and other rivers in destroying young crocodiles and alligators.

294. ORDER SAURIA have generally four short legs; their mouth is always armed with teeth; their toes are furnished with nails, or their feet are palmated or webbed, according to their terrestrial or aquatic habits; their tails at the base are almost as thick as the body itself.

295. This order comprehends five families—Crocodiles, Lizards, Iguanas, Chameleons, and Scincoidiens.

296. Family *Crocodylidae* (Crocodiles) are inhabitants of the rivers and fresh water of the countries bordering on the equator. They are huge and formidable animals, frequently attaining a length of twenty and thirty feet. The head is large, and each of the jaws, which are of an enormous length, is furnished with a single row of teeth. The back and tail are covered with strong plates or shields, so placed as to permit of free motion in all the parts of the body and limbs. The back is impenetrable to a musket-bullet. The legs being short and the feet palmated, the motion of the animal on

land is necessarily slow ; but in the water it moves with great rapidity, the tail acting as a large and powerful oar. This instrument, in which the scales assume the form of a serrated ridge, is a most powerful weapon of defence or attack. Like the vulture, the crocodile usually feeds upon the decayed carcasses



Crocodile.

that may come in its way ; and it is thus of considerable service in those hot countries of which it is an inhabitant. But when it kills for itself, it frequently secretes the body of its prey in some hole at the edge of the water, where it is suffered to putrefy, after which it is swallowed without being masticated. The eggs, which are about the size of those of a goose, are deposited in the sand, and hatched by the heat of the sun. The females guard their young for the first three or four months of their existence, during which time they are in considerable danger of being devoured by the males, as well as by the ichneumon, and other animals. There is only one genus of this family, *Crocodilus*, containing three species—1. The true *Crocodile*, which abounds in the Nile ; 2. The



Alligator.

Alligator, found in the large rivers and swamps of North

and South America; and 3. The *Gavial*, which inhabits India and the islands of the Eastern Archipelago. The Malays consider the hunting of these animals excellent sport. Large parties, armed with pikes, pursue them in the marshes, and kill vast numbers of them.

297. Family *Lacertidæ* (Lizards) have the body elongated, and in general appearance resemble the crocodile, though in point of size they bear no comparison to it. They are characterised by long slender tongues. Cuvier divides them into two genera—the Crocodile Lizards, and the True Lizards.

298. The Crocodile Lizards (*Hydrosauria*) derive their familiar name from their large size—some of them measuring upwards of six feet in length—and from having a crest of spines, similar to that of the crocodiles, upon the tail. In many species, also, the plate-coverings resemble those with which that animal is defended. They are sometimes called Monitors, because they warn each other of the approach of an enemy by a shrill whistling sound. They are mostly inhabitants of South America, frequenting the rank herbage of the savannas and the sides of rivers, where they feed almost exclusively on vegetable substances. Their flesh is considered a great delicacy.

299. The True Lizards (*Lacertæ*) are distinguished from the Hydrosaures by being covered with scales instead of osseous plates or shields; as also by being strictly terrestrial in their habits, as their rounded tail indicates. This genus,



Lizard.

by no means numerous, contains some of the most beautiful species of the saurians. Most of the European, and nearly

all the British Lizards, belong to it. They vary in size from five to thirty inches. Their food consists of insects, frogs, and small mammals. They shelter themselves in old walls and dry places, and, except in tropical countries, pass the winter in a state of torpidity.

300. Family *Iguanidæ* (Iguana, or Guana Lizards) are so called from the name given to many of them by the natives of tropical America, where the most typical examples are found. They are chiefly distinguished from the true lizards by a short and thick tongue, with the extremity very slightly cleft. They live chiefly among the branches of trees, feeding upon leaves and fruit, together with insects and eggs.

301. This family has been divided into five genera—Iguana Proper, Gecko, Stelio, Polychrus, and Anolis.

302. *Iguanas*, properly so called, are, like the true lizards, covered with small imbricated scales; but are distinguished from these by a dorsal crest, and by the slender and compressed character of their tail. They also differ from them by having a large thin fold of skin, or dewlap, under the chin, and porous tubercles in the thighs. Each jaw is furnished with a range of triangular teeth, with the edges finely sharpened, and a double row also on the palate. They feed on vegetable substances, and live chiefly upon trees, though they frequently enter the water. Many of the species attain a length of four and five feet; and both their flesh and eggs are esteemed delicate food.

303. The *Geckoes*, or Nocturnal Lizards (*Platydictylus*), have not the attenuated form we generally find in reptiles of this order, but have a flattened body and a broad head, which, aided by their sombre colour, gives them a disagreeable appearance. Though the Geckoes are timid and harmless, they are always regarded by the vulgar as having a venomous character. They frequent buildings. Most of them present a curious organisation of the foot, by which the sole is converted into a sucker, enabling the animal to creep up vertical walls and along ceilings, like the flies upon which it feeds. They are common in the warm climates of the Old and New World.

304. *Stelios* have the depressed head and body of the Geckoes, and much of the same forbidding appearance; are chiefly distinguished from them by their tails, which are encircled with rings of large scales. Their neck is narrow, and the head generally much enlarged behind by the muscles of the jaws.

305. The Marbleds, *Polychrus* (πολύς, many, and. χεῖρα, colour), are furnished with a large lung, which fills nearly the whole

body, and, subdivided into numerous cavities, gives them the power of changing their colour like the chameleon. Their ribs surround the abdomen, and form complete circles; and the tail, which is round, is more or less prehensile. They have no crest.

306. *Anolis* is the vernacular name in the Antilles of the lizard, to which the generic term *Anolis* is applied. They are remarkable for the faculty of inflating an appendage under the throat. They are light and agile in their movements; and in the beauty and brilliancy of their colour exceed all others of the saurian order. One species, the Basilisk, is distinguished by a mitre-shaped crest on the top of its head.

307. Family *Chameleonidæ* (Chameleons) are animals of



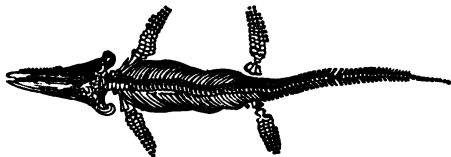
Chameleon.

small size, with a prehensile tail. They are readily distinguished from the other lizards by having scansorial or climbing feet, similar in their general structure to those of parrots. They are natives of the warm parts of the Old World, and live in trees, which they seldom leave. Their prey, consisting of flies and other insects, is taken by darting out the tongue, which is terminated by an adhesive disk. They are capable of directing their eyes in two different ways at once—a faculty useful in giving information of the proximity of food in any direction. They are also remarkable for the power they possess of changing their colour, which is supposed to arise from the layers of the skin containing two kinds of pigment, situated at different depths.

308. Family *Scincoidæ* (Skinks, or Serpent-like Lizards) are so called from their general resemblance to snakes. Their

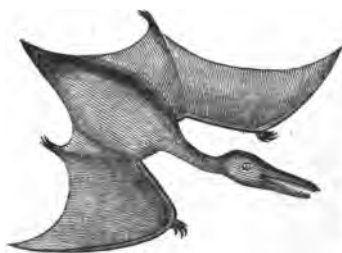
feet are very short, their body much elongated, and they are for the most part covered with serpent-like scales.

309. Geology has made us aware that there was a period in the history of the globe, during which animals of this order, exhibiting some highly peculiar features, were the chiefs of creation, no mammalian animals then existing. The *Ichthyosaurus* was a marine animal, sometimes as much as twenty



Ichthyosaurus.

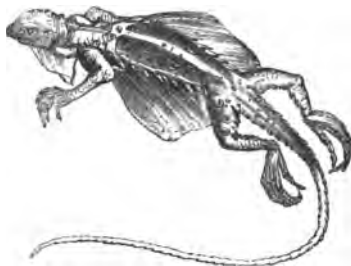
feet in length, possessing the vertebræ of a fish, with paddle-feet, like those of a turtle, and a crocodile-like head, armed with sharp and formidable teeth. Its fossil remains abound in the lias and oolitic formations. The *Plesiosaur* was a smaller animal, with a neck of extraordinary length, and a small head. It probably swam about on the surface of the water, arching its long neck in all directions on the outlook for fish, at which it would be able to dart its head, even to the depth of several feet. There were also land Saurians, of colossal size, the *Megalosaurus*, *Geosaurus*, and *Iguanodon*, the last being so named from its teeth resembling those of the Iguana Lizard, arguing herbivorous habits. But the most singular fossil saurian is the *Pterodactyle*. By an



Pterodactyle.

extraordinary development of the forefinger, it was furnished with a pair of large wings, like those of the bat, and thus is supposed to have been enabled to pursue insects in the air.

The only animal of the existing time approaching to the character of the Pterodactyle is the *Draco Volans*, or Flying



Flying Lizard.

Lizard, a small creature, possessing a membrane at its sides, by which it can float, as upon a parachute, from one tree to another.

310. ORDER OPHIDIA have the remarkable distinction of being destitute of limbs, yet are in their general characters so like saurians, that some naturalists decline to consider them as a separate order. In the possession of teeth, and in the scaly covering of their bodies, as well as in their general internal organisation, they closely correspond with the lizard tribes; and a further connection is shewn in the fact, that while some lizards have only two feet, some serpents shew the rudiments of the same number of limbs, though of no observable use. The serpents appear designed for a furtive life in grass and shrubbery, where they prey upon small animals. Their elongated bodies move in two ways—by alternate extensions and contractions, after the manner of worms, and by a series of arches, the straightening of which causes the head to keep continually advancing. They remain torpid during winter, and each season cast their skin. The tongue is forked. All are furnished with teeth, of which the greater number of species have three rows. A smaller number have only two rows; but as if to make up for this comparative weakness, they possess two fangs, containing poison—a peculiarity, it may be remarked, always inferring feebleness, or the want of other means of defence, in the animals exhibiting it. The serpent has from two to three hundred vertebrae; the head is small, but for its size has a large swallow, so as to admit of the prey being eaten entire. Like lizards and tortoises, the serpents are oviparous; but in some the eggs are retained so

long as to be in a manner hatched within the body of the parent, and thus are born alive.

311. The order comprehends five families.

312. Family *Anguinidae* (Slow-worms) are generally of small size and harmless. In their structure they make an approach to the lizards, the bones of the pelvis and shoulder existing in a rudimentary state under the skin. The common Slow-worm, or Blind-worm, of this country has received its second name from the supposed absence of eyes; this is an absurd error, however, as the eyes, though small, are very brilliant. It is a perfectly harmless animal, feeding on insects, slugs, &c. It is said to swallow frogs, birds, and mice; but this is impossible, as the bones of its jaw do not separate in the middle, and its swallow is consequently small and not dilatable. When alarmed, it throws the whole of its muscles into contraction in a peculiar manner, and is then very brittle, so that it frequently loses its tail by various accidents; in the course of a year, however, this member is replaced. There is a larger species of this family existing in America, which attains the length of two feet, and from its extreme brittleness, is called the Glass-serpent.

313. The *Hydrophidae* (Water-serpents) are comparatively few, and are limited in their geographical range. They are mostly found in the seas and rivers of the East Indies, and in some localities they are by no means uncommon. They are chiefly known by the very decided vertical compression of the tail and hinder part of the body, which may thus be compared to the tails of fishes; hence they swim with considerable facility, occasionally coming to the surface to respire. They possess poison-fangs, and are more dangerous than crocodiles or sharks to persons entering the water where they abound.

314. The *Amphisbaniidae* (Double-walkers) are a still smaller group, intermediate in some respects between the slow-worms and the true serpents. They derive their name from the power of moving either backwards or forwards with equal facility. The two extremities of the body are so much alike, that they would not be distinguished by a superficial observer, the eyes being so very small as sometimes to appear wanting; the whole body is of nearly equal diameter. This group is restricted to the warmest parts of South America. Notwithstanding the common idea of its venomous properties, it is quite harmless, and subsists on ants and other small insects. It has not the power of separating the bones of the jaws, which distinguishes the true serpents.

315. Family *Crotalidae* includes the great bulk of the venomous species. Their type is the Rattlesnake, so called from the sound produced by a series of horny rings at the

extremity of the tail when the animal is in motion. The poison-fangs are each pierced by a small canal, which gives issue to a poisonous fluid. When not in use, these lie incased in the upper gum; but when the animal is irritated, they are unfolded, and struck into the victim, the poison being at the same time ejected with great force by the action of the muscles that shut the lower jaw. The matter is poisonous only when introduced into the blood. The bite of the rattlesnake produces almost instantaneous death; but they never attack man unless when trodden on or provoked. Their food consists of birds and small animals, and such is the terror with which they inspire these creatures, that it often renders them incapable of saving themselves by flight. This may have given rise to the supposition, that rattlesnakes had the power of fascination. Some species are from five to six feet in length, and about the thickness of a man's arm. Besides their other peculiarities, this genus is also remarkable for a deep hole behind each nostril, the use of which has not been ascertained.



Rattlesnake.

316. The Vipers (*Vipera*, a contraction of *vivipar*—*vivus*,



Puff Adder.

alive, and *paro*, I bring forth) are produced from eggs; but in the act of deposition, the covering is broken, and the young come forth alive. They are distinguished from the former genus by a broader head, and by the absence of the rattle, as well as the cavities behind their nostrils. Vipers are most abundant in hot

countries, where they attain the largest size. The Common

Adder and the Black Adder are the only two species of venomous serpents indigenous to Britain.

317. Family *Coluberidæ* (True Snakes).—This group, which is non-venomous, and very extensive, includes all those serpents in which the subcaudal plates are arranged in pairs, thus comprising the largest serpents in existence. Most of the family have the greater number of the characteristic properties of the order highly developed. This family, *Coluberidæ*, consists of Boas, Pythons, and Colubers.

318. The *Boa Constrictors*, which are peculiar to the tropical



Boa Constrictor.

regions of America, are characterised by having the under part of the body and tail covered with transverse shields. Many of the species have been known to exceed forty feet in length, and they can swallow large animals, such as sheep and even oxen. This they effect by coiling themselves round the body of the victim, and crushing it till every bone is broken. They then moisten it with saliva, and proceed to swallow it. The *Pythons* are inhabitants of Asia, and differ from the

Boas principally in having the plates under the tail double. Though many of them are as large as the Boas, yet they feed on birds, rats, and other small animals. The serpents exhibited in this country under the name of Boa Constrictors are mostly Pythons. The *Colubers*, properly so called, are inhabitants of Europe. They sometimes attain a length of six or seven feet. In appearance they resemble the Pythons, and, like them, feed on small animals, such as insects, mice, and frogs. They prefer marshy situations.

319. There is also an important group of coluberiform serpents which are venomous, inhabiting India and Africa. They are externally distinguished by little more than the comparative thickness of the muzzle. The most formidable of the



Cobra da Capello.

group is the *Cobra da Capello* of India, the bite of which is fatal within an hour.

320. ORDER BATRACHIA (from *βάτραχος*, a frog) includes frogs, toads, and such reptiles as have no scales, but a naked and moist skin. They are remarkable for a curious peculiarity attending their reproduction. On issuing from the egg, they are in an immature state, possessed of gills, and thus fitted to live in the water. The order comprehends three families, respectively represented by the Frog, Toad, and Newt.

321. Family *Ranidæ*, or Frogs (*rana*, a frog), are so well

known that a description of them seems unnecessary. Their power of leaping is remarkable, and they are the best swimmers

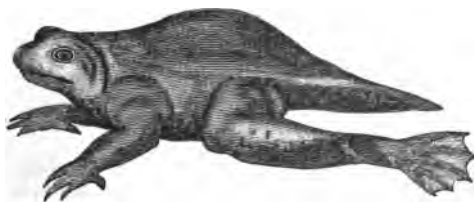


Frog.

of all four-footed animals. They are of a yellowish brown colour, with black spots. Their mode of breathing is one of the most curious characteristics in their organisation. Their inspiration is effected by the muscles of the throat, which, by dilating, draw in air through the nostrils. The contraction of these muscles, while the nostrils are closed by the pressing of the tongue against their interior orifices, and the mouth at the same time being shut, compels the air to enter the lungs. The animal would thus be choked if the mouth were kept open. Their expiration, on the other hand, is produced by the contraction of the muscles of the abdomen. In cold regions, frogs pass the winter in the ground, or in mud under water, without eating or breathing. The spawn, consisting of a vast number of eggs, each of which is surrounded by a covering of transparent glutinous matter, is deposited at the bottom of some stagnant-pool early in spring. Owing to some partial decomposition, and the consequent disengagement of a gas, the entire mass becomes lighter than the surrounding water, and rises to the surface. The young then burst from their prison, and feed on vegetable matter. In the early stage of their existence, they are called tadpoles, and are of a black colour. They breathe by gills, and are characterised by a round head and long tail. In this state, they may be regarded as fish in all essential respects. They increase for a time rapidly in size, without undergoing much change in form, till they attain a length of about an inch. The hind feet are then developed; next, the anterior extremities assume their ultimate form, the

tail is gradually absorbed, the hinder part of the body becomes rounded, and the beak falls off, discovering the true jaws. The eyes, which in the tadpole were only discerned through a transparent spot in the skin, become visible with their three lids; the gills are obliterated. As soon as they have effected their metamorphosis, they breathe by lungs, and become carnivorous, feeding upon insects, slugs, and similar animals. The Common Frog (*R. Temporaria*) is the only species indigenous to Britain.

322. The *Surinam Frog* is remarkable for being much smaller in the mature than in the immature state, the tadpole



Surinam Frog; half of real length.

being fully eight inches long, while the frog is diminished, chiefly by the loss of its tail, to three.

323. The Tree-frogs (*Hyla*) differ from the common frogs chiefly in having their feet provided with suckers—a conformation which enables them to adhere to the surfaces of bodies, and even climb trees. This they do in pursuit of insects. These also lay their eggs in the water, and hibernate during winter. They are natives of America, and many parts of Europe; but are never found in Britain.

324. Family *Bufoidæ* (Toads) resemble the frogs in figure, but are of a dull cadaverous hue, and covered with warts. Their movements are slow. They are characterised by a swelling above each eye, from which a fetid milky excretion is expressed; but this is said to be destitute of any venomous quality. They are useful in gardens, as they feed on worms, slugs, and wasps; yet they are hated and persecuted by the ignorant. They seldom frequent the water, but for the purpose of depositing their eggs. Their hibernation is passed on land, either in some sheltered space, or in burrows which they excavate for themselves beneath the surface of the ground. Two species are found in Britain, the *Common Toad* and the *Natterjack*. The former progresses more by leaping than crawling; and the latter does not leap, but creeps, which it

does with considerable celerity. The natterjack is found in the heaths of the south of England. Other species are the *Bombinator*, the *Rhinella*, the *Antilophus*, the *Breviceps*, and the *Pipa*.

325. The family of Salamanders, the largest of which does not exceed two feet in length, have the body and tail elongated. They bear a strong resemblance to the lizards in their general form, but are easily distinguished from them by their smooth soft skin. They may be subdivided into three genera—the True Salamanders, the Tritons, and the Amphibious Newts.

326. The *True Salamanders* remain in the water during their tadpole state. In their adult condition, they live principally on the land, and frequent their original element only for the purpose of depositing their young, which are produced alive. There are few of these reptiles in Europe; in America, many have of late years been discovered. The surface of their bodies, like that of the toad, is somewhat warty, and they have a gland containing an acrid secretion said to be poisonous. Their tail is cylindrical, or rounded. Eggs are hatched within the body, and young are produced alive. These animals prefer damp and humid places, particularly at the edges of walls, hiding among rank-grass, where their food, which consists of slugs and worms, is readily procured.



Newt.

327. The *Tritons*, or *Aquatic Salamanders*, commonly called *Newts*, pass the greater part of their life in the water. Their tail, which is their chief organ of locomotion, is vertically compressed, or oar-shaped. They possess the extraordinary power of reproducing limbs that have been cut off. There are three species indigenous to Britain.

328. The *Amphibious Newts* (*Amphineusta*) which are similar in form to the two preceding genera, breathe both by lungs and gills, respiring by the former on land, and by the latter in water; and are the only true amphibians among vertebrated animals. This genus, consisting of the *Proteus*, the *Syrens*, and some others, are chiefly inhabitants of the American continent.

CLASS BIRDS.

329. The third class of vertebrated animals is the BIRDS, in which we for the first time find a complete double system of circulation, attended with its proper consequence of warm blood, while yet they maintain the oviparous mode of reproduction which we have seen in Reptiles, only with the additional peculiarity of a hatching and nurturing of the young by the parent. The most remarkable external features of the class are—the having the body covered with feathers instead of hair or wool, and, as a rule, the fore-pair of limbs adapted to serve as wings, in enabling the animal to maintain flight in the air. In their internal structure, birds are distinguished by having the lungs, which are larger than in the mammalia, fixed to the ribs, and pierced in such a way as to permit the air not only to pass into the chest, but also into various other cells, that can be inflated or emptied at pleasure. This organisation, by increasing their buoyancy, adapts them to range over the aerial regions with an ease and celerity to which there is no parallel in nature. Their powers of vision are more highly developed than those of any other class of vertebrated animals, the eye being generally so constructed that they can see objects far and near with almost equal clearness.

330. The posterior extremities of birds serve as the sole support of the body on the ground, and are usually placed rather far back. Most commonly, the feet exhibit four toes, of which one is directed behind and three in front; besides which there is, in the fowl tribe, a *spur* behind, analogous to the thumb on the human hand. In the ordinary single posterior toe, the number of joints is only two; in the external, it is five. The toes terminate in claws, and these are of great strength and sharpness, where they are to be used in clutching and tearing prey.

331. Birds have no teeth, properly so called, and cannot

therefore masticate their food, which is either torn by the beak or swallowed whole—its reduction to a soft and pulpy state being entirely performed in the stomach. The plan of the digestive system most usual in this class is that which is exemplified in the common fowl. The stomach consists of three cavities: the first being formed by an expansion of the gullet, which produces a bag or chamber known as the *crop*. In this receptacle the food is stored up, and transferred by degrees to the second or membranous stomach, where it is softened by the action of the gastric-juice. It is then conducted to the *gizzard*, or third cavity, in which the process of digestion is completed. This last stomach presents modifications varying with the nature of the food on which the bird subsists. If it feeds on grain, the sides of this stomach are of considerable thickness, and are moved by powerful muscles, which act as a mill in grinding down the food; but in those species which subsist on animal substances, or on soft herbage, the muscles are reduced to extreme delicacy. In many cases the process of digestion is promoted by the swallowing of small pebbles, which, being brought into contact with the food in the gizzard by the muscular action of the stomach, produce an effect similar to that of teeth, and in some measure serve the purpose of these agents.

332. The change of the plumage, termed *moulting*, generally takes place annually; while with some species a partial casting of the feathers occurs also at the breeding-season. Many birds migrate from one latitude to another, chiefly for the sake of obtaining a better supply of food. The summer immigrants that visit our island—as the swallow, the rail, and the cuckoo—are from tropical regions; while all winter visitants—as the swan and the wild-geese—come from the north. The northerly position is the one adopted by the bird for its summer residence, and the bringing forth of its young.

333. Not only do birds resemble insects in their general structure and mode of life, but also in the peculiar development of the instinctive powers. Under the direction of these, the place for their nests appears to be selected, their materials collected, the nests themselves built, and the young reared in them, the migrations are performed, and many curious stratagems are employed to obtain food. These it is sufficient thus to indicate in general terms, since it is well known that each species has some peculiar habits, while in all the individuals of each, they are as precisely alike as their circumstances will admit. Nevertheless, there is observed in birds a degree and kind of adaptation to varying conditions which

insects do not possess, and an amount of *intelligence* superior to what is found in that class. And in the domesticability of many tribes of birds, we see an obvious approach towards that higher form of attachment to man which is exhibited by many species among mammalia.

334. Birds are of great utility to man, not only as an article of food, but also by keeping in check noxious animals, as insects and snakes, and in consuming carrion and other refuse.

NATATORES.

335. ORDER NATATORES, or *Swimmers*.—A considerable number of the birds are adapted to an aquatic life, and spend great part of their time upon the surface of the sea, or on rivers and lakes. These are regarded as forming a distinct order, characterised by that webbed form of foot which serves for swimming, and named accordingly *Swimmers*, though in reality the order includes birds of great variety of character, both in form and in disposition and habits. The legs are short, and placed behind the point of equilibrium. The body is closely covered with feathers, and coated with a thick down next the skin. It is in this order that we find the nearest approach to reptiles which is to be found amongst the Birds.

336. The *Alcidae* (Auk tribe) exhibit the most remarkable adaptation of the structure of the bird to an aquatic life, with which the entire order presents us. This is best seen in the *Penguins*, whose wings are very small, and covered with mere vestiges of feathers, which resemble scales; so that they serve as admirable fins or paddles, but are totally useless for flight. The feet are placed very far back, so that when upon land the bird stands nearly erect. Having no power of flight, and not being able to run, the penguin may be overtaken with ease upon land; but once in the water, it distances its pursuers, swimming with the ease and rapidity of a fish, and springing several feet over any obstacle that may impede its course. Besides other characters which are considered as indicating an approach towards the reptiles in this tribe, the penguin is especially remarkable for having the kind of ball-and-socket union of its vertebræ which is peculiar to that class. The penguins are exclusively inhabitants of the southern seas; but there are birds of the northern ocean which approach them in their peculiar characters. Such are the *Puffins* and *Auks*; the former have short wings, which can sustain them for a little while; of the latter, one species has wings well adapted for flight, whilst in the other, the wings are adapted

to aquatic progression almost as exclusively as in the penguin. The Puffin, which comes to Britain both from the north and south, and is often found breeding in old rabbit-holes near the sea, has a short deep narrow bill, and horny



Puffin.

appendages over its eyelids. Watching on cliffs over the sea, it no sooner sees a proper prey, than it plunges like a dart into the water, and often captures three or four sprats at once.

337. In the family *Colymbidæ* (Divers), as in the penguins, the wings are remarkably short, and the feet placed so far behind the point of equilibrium of the body, that they are ill adapted for walking. Of the genus *Colymbus*, the *Northern Diver* or *Loon* is a familiar example. It is generally an inhabitant of the most northern parts of the Old and New World; but on the approach of winter, it journeys southward, and is then occasionally found in Scotland. It is said to be able to swim below the surface of the water for a couple of hundred yards, in pursuit of its prey, which consists of small fish. The *Guillemots* bear more resemblance perhaps to the auk family, but resemble the divers in using their wings to propel themselves under water. The *Grebes* (*Podiceps*) are more inland in their habits, living chiefly on the borders of lakes. The toes are separate, but each has a fin-like membrane

along the side, presenting a considerable surface to the water.



Grebe.

338. Family *Pelecanidae* (Pelicans) consists of three genera, represented by the Pelican, Cormorant, and Solan Goose.

339. The *European Pelican*, which may be taken as a



Pelican.

representative of the Pelican genus, is as large as a swan, and altogether white. It has a long, slightly curved bill, and

is remarkable for possessing a large neck-pouch, in which it stores provisions and water. It has been affirmed that this pouch will contain as many fish as would serve sixty hungry men for a meal. The habit of feeding its young from this receptacle is probably what has given rise to the popular notion, that the pelican sheds the blood of its breast for the sake of its hungry progeny. The bird makes its nest in marshes, but roosts on trees.

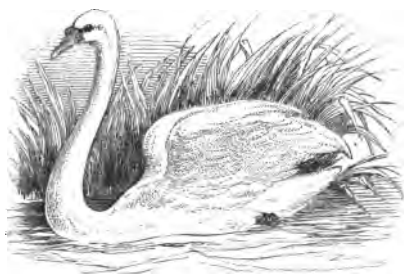
340. Genus *Phalacrocorax* (Cormorants).—The *Black Cormorant* is about the size of a goose, and of a bronze black colour. It is very common on the British coasts, and in former times it was trained in Europe, and still is by the Chinese, for fishing, as hawks are for fowling. The cormorant is proverbial for its voracity. It carries on its ravages by night and by day. It dives to catch its prey, which it can pursue for nearly one hundred yards below the water, before it is obliged to come up for air.

341. Genus *Sula* (the Gannet or Solan Goose).—These birds take their prey by hovering in the air at some little distance above the surface, and then dropping down upon any fish that they may see rising within their reach. The air-cells are very largely developed, especially under the skin of the breast, which is almost completely separated by them from the muscles beneath; and it is probable that they may serve as an elastic cushion, to break the force with which the body of the bird would otherwise impinge on the water. These birds haunt the cliffs of solitary islands, for the purpose of bringing forth their young. The Bass Rock, in the Firth of Forth, and Ailsa, in the Firth of Clyde, are noted habitations of the *Solan*. It is eatable, but forms rather a coarse dish for most palates.

342. Family *Anatidæ* (Ducks) is divided into three genera, represented by the Swan, the Goose, and the Duck.—They are all remarkable for a broad bill, horny at the extremity, while the rest is invested in a membrane, and terminates at the edges in laminæ or little teeth, forming a kind of strainer for gathering food in a watery element. The birds of this family are highly serviceable as food.

343. Genus *Cygnus* (Lat., a Swan).—There are several wild species of this genus, of which the most remarkable is the *Hooper* or *Whistling Swan*, a native of the arctic regions, but which migrates southward in flocks ranged in the form of the letter V, when we occasionally hear it uttering its loud note, softened by distance. The tame Swan (*C. olor*), called the *Mute Swan*, to distinguish it from the preceding, is a beautiful ornament to our rivers and lakes. It is one of the most elegant birds, lives almost entirely upon the waters, and feeds

upon aquatic plants, frogs, and insects. Swans are remarkable for their longevity, some having been known to live a hundred years.



Swan.

344. Genus *Anser* (Lat., a Goose) presents several wild and migratory species both in the Old and New Worlds. They all live upon vegetable substances, and are consequently useful as food. The *Canada Goose* going northward every summer, is of great service to the Hudson's Bay residents, who kill and preserve great quantities for their winter provision. Our own tame goose is supposed to be derived from the *Gray Lag Goose*, once very abundant in the fenny districts of Lincoln and the neighbouring counties, and permanently resident, but, like other species, now only seen in small flocks as a winter visitant.



Eider Duck.

345. Genus *Anas* (Lat., a Duck) includes many species, as the Velvet Duck, the Eider Duck, Shoveller, and Sheldrake;

all of them wild animals, frequenting pools and other waters remote from human haunts. The *Mallard*, or *Mire Duck*, is the parent race of all the common ducks. It is permanent in many parts of Scotland in lakes and marshes, but receives a vast accession to its numbers on the approach of winter from northern countries. The habits of the *Common Duck* are familiar: in its researches for food amongst mud and turbid waters, it is understood to be much assisted by the sensitive skin of its bill, which enables it to feel, or, as it were, grope for objects which it may devour.

346. Family *Laridæ* (Gulls).—This tribe performs the same office on the sea that vultures do on land, feeding upon carcasses of every description that float on its surface, or are cast upon its shores. They are found in all latitudes, but are larger and more numerous in the northern regions. They are arranged into five genera—Gulls, Terns, Skuas, Petrels, and Albatrosses.

347. Genus *Larus* (Gulls Proper).—The *Common Gull* (*L. vulgaris*), the type of the genus, is about one foot and a half in length, and three feet in the expanse of its wings; above, it is of a bluish-gray, and white beneath. It makes its nest of sea-weed, on the ledges of rocks on the coast. On the approach of stormy weather, it has a propensity to leave the shore, and to whirl round and round in circles at a great elevation.

348. Genus *Sterna* (Terns) are sometimes called *Sea-swallows*, from the resemblance they bear to the land-swallow in their long-pointed wings and forked tail. They are also similar to that bird in their port and flight, but differ very much from it in their habits. Their food consists of mollusks and small fish. The tern is often seen chasing a small gull, and, as it were, persecuting it, in order to force it to disgorge the fish it may have taken. As soon as the fish has been dropped, the tern descends like an arrow, and generally succeeds in catching the meal before it reaches the surface of the water. The *Common Tern*, which is about fourteen inches in length, is a periodical visitant in Britain, arriving in April and leaving in September. In very stormy weather, it may be seen following the river-courses in pursuit of its prey.

349. Genus *Lestris* (Skuas) are nearly allied to the Terns, but are more powerful birds. Their peculiar habitation in this country is the Shetland Islands, where they nestle and breed in communities on wild and unfrequented heaths; but as soon as the breeding has ended, they go each its own way to the adjacent seas and lead a solitary life, feeding on fish offal and animal matter. Like the terns, they pursue gulls

till they oblige them to disgorge what they have swallowed. The entire length of the *Common Skua* is about two feet; the wing measures sixteen inches, and its general colour is a reddish-brown.

350. Genus *Procellaria* (Petrels).—The name *Petrel* is a diminutive of Peter, and has been applied to those birds from their habit of walking on the waves. This they effect by striking their feet rapidly against the water, and at the same time supporting themselves with their wings. One species, the *Giant Petrel*, is as large as a goose; it is found only in the South Seas. The most common one, called by the mariners *Mother Carey's Chicken*, is found in most seas. When it seeks shelter upon vessels, it is generally supposed to indicate storms and shipwrecks. During the greater part of the day, it conceals itself in holes and crevices of rocky shores. In the evening it comes forth, and flies close over the surface of the sea, in search of floating insects and dead animal matter. This species is of a brownish-black, and it differs little from the common swallow either in size or appearance.

351. Genus *Diomedea* (Albatrosses).—The *Common Albatross* (*D. exulans*) is the most bulky of all aquatic birds, measuring twelve feet and upwards between the extremities



Albatross.

of the wings, and has a wide range upon the ocean, but abounds chiefly within the tropics. It has a large, strong, trenchant bill, marked with sutures or joinings, and terminating in a stout hook. It is very voracious, and is said to destroy numbers of the flying-fish, when they are forced to seek refuge in the air.

GRALLATORES.

352. The ORDER of GRALLATORES (*Waders* or *Stilt-birds*) derive their name from their habits and conformation. Their long legs raise up their bodies, as it were upon stilts, and thus elevated, they frequent the banks of rivers and lakes, marshes, the shores of estuaries; and whilst resting with their feet upon the land, derive their nourishment chiefly from the water—some feeding exclusively upon small fishes, aquatic mollusca, worms, small reptiles, and water-insects—whilst others are of more terrestrial habits and food. Such as are more especially aquatic have a short web to their toes. Their wings are long, affording them that power of changing their habitation with the seasons, which most of them enjoy. During flight, they stretch out their long legs behind, to counterbalance their long necks; and the tail is always extremely short, its function as a rudder being transferred to the legs. They mostly construct or choose their nests upon the ground; and the young are enabled to run about as soon as hatched, except in those species which live in pairs. The *Waders* are remarkable for their power of preserving a motionless position upon one leg for a considerable time.



Crane.

353. Family *Gruidæ* (Cranes).—Of this family we shall notice only one species, the *European Crane* (*Grus cinerea*).

In Britain its appearance is now exceedingly rare, though in former times it was well known in many parts of England. It is described as a beautiful sight to witness thousands of them passing over the Mediterranean, northwards and southwards, as the case may be, in marshalled order, in groups of from twenty to sixty, and each group headed by one of the larger birds. It is with reference to the regularity of the migrations of these birds, that Jeremiah, viii. 7, says: 'Yea, the stork in the heaven knoweth her appointed times.' The crane roosts on the ground in open situations void of trees, and its food consists almost exclusively of vegetables. Its length is nearly five feet, and its weight about ten pounds.

354. Family *Ardeidae* (Hérons).—The *Common Heron* (*Ardea cinerea*) is of very general distribution, and is a well-known bird in Britain. It passes the winter in the southern parts of Europe and in the north of Africa, migrating thither in autumn, and returning northward in spring. The extreme length of the heron is about three and a half feet; its general colour is an ashy gray with a bluish tinge; and its head is ornamented with a crest. It builds on lofty trees, especially on oaks, in the neighbourhood of streams and marshes. The heron is very expert in catching fish, on which it principally feeds, though it does not despise mice and reptiles.

355. The *Bittern* or *Mire Drum* (*Botaurus stellaris*), a species of heron, was once well known in Britain, but is becoming rare as waste lands are reclaimed. Its general resorts are extensive swamps covered with tall flags and rushes. The bittern is the emblem of desolation, and as such is spoken of by the prophet in his denunciation against Babylon: 'I will also make it a possession for the bittern, and pools of water: and I will sweep it with the besom of destruction, saith the Lord of hosts.' The booming of the bittern is peculiarly dismal. It resembles the interrupted bellowing of a bull, but is more hollow, and is heard at the distance of a mile. From this circumstance, and the lonely marshes it inhabited, it was the unconscious hero of many a ghost-story in the superstitious ages that are past.

356. The *Stork* (*Ciconia alba*) stands about four feet high. It migrates in summer from Africa into a wide range of more temperate latitudes, and, in many countries widely apart from each other, is held, as it were, sacred, on account of its destruction of vermin. This has rendered it very familiar, and in Holland they prepare false chimneys on the tops of their houses, that the stork may build in them, each regularly returning to its own nest every year. Owing

probably to the improved drainage of the country, the stork is now a rare visitor of Britain.



Stork.

357. The family *Scolopacidae*, composed of Snipes and Wood-cocks, has the Wood-cock (*σκολόπαξ*) for its type. These



Ibis.

birds are remarkable for their long and slender bills; the use of

which is restricted to searching in the mud for worms and insects. To this family belongs the *Ibis*, an African species, once held in great veneration in Egypt, and embalmed among the ancient people of that country, in consequence, it is supposed, of its usefulness in devouring serpents.

358. The *Wood-cock* is a well-known species in Britain, where it arrives in flocks from the northern countries. It is about the size of a pigeon, and has beautifully mottled plumage. It feeds on worms and insects, which it searches for with its long bill in moist situations, under the cover of young trees, and near hedges by the sides of rivulets. As an article of food, it is much esteemed for its exquisite flavour. The *Common* or *Whole Snipe* is one of the most common winter visitants of the British Isles. It chooses swampy parts of meadows; and small worms, insects, and vegetable substances seem to constitute its food. Its entire length is about twelve inches, and weight about four ounces. The *Half* or *Jack Snipe* is a minute species, its length being only eight inches. It resembles the other in its habits, only it is more solitary. The *Curlew* also belongs to this family.



Curlew.

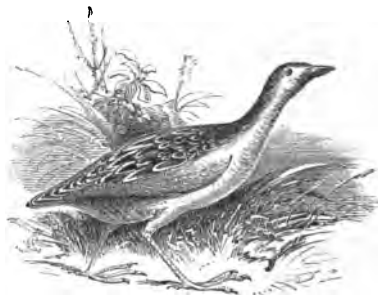
It is a well-known bird, haunting sandy shores during the whole winter for minute crustacea and worms, and breeding in summer in heaths and bogs. The name is derived from the bird's peculiar cry.

359. Family *Rallidæ* (Rails) consists of five genera—*Gallinula*, *Fulica*, *Rallus*, *Jacana*, and *Phœnicopterus*.—The *Water-hen* is a species very common throughout Europe.

In summer, it is found in almost every pond, lake, and quiet water-course. Its colour is a deep olive-brown above, and slaty-gray below, with a frontal shield of bright red. It is rather more than a foot in length, and weighs about fifteen ounces.

360. The *Coot* (*Fulica atra*), a well-known bird, found wherever there is a pond, is migratory, and arrives here in large flocks from more northern latitudes, though many of them are constantly resident. Its size is equal to that of a common fowl.

361. The *Rails* (*Rallus*).—The *Landrail* or *Corncrake*



Rail.

(*R. pratensis*) is a regular summer visitant in the British Isles. It conceals itself so well among the grass and young corn, that were it not for its cry, few persons would be aware of its presence amongst us. It is larger than a blackbird, and is of a reddish-brown colour.

362. The *Jacanas* and *Flamingoes* are classed with the Rail family. They inhabit the marshes of hot countries. The common species of the flamingo, *Phaenicopterus* (wings of flame), is from three to four feet in height. It is purple-red on the back, and has rose-coloured wings. The mandibles are abruptly bent downwards, about the middle of their length; and they are roughened at the edges, like those of the ducks, to which the fleshiness of the tongue also shews an alliance. They feed on mollusca, insects, the spawn of fishes, &c., which they seize by means of their long neck, turning the head downwards, to use to advantage the crook in the upper mandible. They construct their nests in marshy situations,

placing themselves astride of them during the act of incubation, being incapacitated by the length of their legs from sitting on them in the usual manner.



Flamingo.

363. The *Charadriadae*, or *Plover tribe*, are less aquatic than most of the other families. The legs are long, and the back-toe is either quite absent, or so short as not to reach the ground. They live only on sandy and unsheltered shores, or on exposed commons, congregating in flocks, and running with great swiftness. The bill is usually of moderate strength, enabling these birds to penetrate the ground in search of worms, to obtain which they have the habit of patting with their feet, which causes the worms to rise. The species in which the bill is more feeble, frequent meadows and newly ploughed land, where this food can be obtained with greater ease; those which have stronger bills subsist additionally on grain, herbage, &c. Of the plovers, several species exist in Britain, and others are distributed through most other countries. Some chiefly frequent the sea-coast, and others the upland moors. The *Lapwings* are nearly allied to the plovers, and, like them, are migratory, passing the winter in warm latitudes; they are peculiar to the Eastern hemisphere. They are very noisy birds, screaming at every sound they hear, and defending themselves with courage against birds of prey. They derive their name from the stratagem by which they lure away intruders from their nests: they drop their wings in flight.

appearing as if wounded, and thus induce their pursuers to follow them to a considerable distance.

364. Three other genera of this family are worthy of notice. The *Bustards* connect the *Grallatores* with the *Rasores* in the heaviness of their bodies, the small membrane at the base of their toes, and some other characters. They have, however, the long naked legs of this order, and the flavour of their flesh resembles that of the wading-birds. They fly little, scarcely ever using their wings, except, like the ostriches, to assist them in running; but their flight, when they do rise, is easy, and capable of considerable duration. They feed equally on grain, herbage, worms, and insects. The great bustard is the largest of European birds, and is one of the finest kinds of game; it has been nearly extirpated in Great Britain. The *Turnstone* is at once recognised by a short stout bill, rather turned upwards; the name is derived from the habit it possesses of turning up stones on the sea-shore, to feed upon the marine animals concealed beneath. The *Oyster-catcher* has a long, straight, wedge-shaped beak, which is strong enough to enable it to force open the bivalve shells of the mollusks upon which it feeds.

CURSORES.

365. ORDER CURSORES, or *Runners*, exhibit a remarkable exception from the class in general, being without powers of flight, and possessing at the utmost only the rudiments of wings. Instead of such powers, these birds have remarkably strong limbs, adapted for rapid running over the wide-spread plains which they inhabit. Hence their name as an order. In some respects they approach the mammalian character, their feathers being much like hair, and one of the family having the rudiment of both a diaphragm and a bladder, wanting in birds in general.

366. The *Ostrich* is a well-known bird in the tropical parts of the Eastern Hemisphere. Its specific name of *Struthio camelus* was conferred in allusion to certain points of analogy between it and the camel; it is an inhabitant of the wide-spread deserts of Africa and Arabia. It is incapable of flight, but is remarkable for its swiftness of foot, being able to outstrip the fleetest horse. The height of the adult male is from seven to eight feet in the upright position. The *Great Bustard* (*Otis tarda*), which may be considered as the European representative of the ostrich, was once common in Britain, where, however, it is now of rare occurrence, being chiefly confined to the county of Norfolk. It runs with extreme

rapidity, and, unless closely pursued, seldom takes wing. It frequents extensive plains, and nestles among the corn. Its



Ostrich.

weight is from twenty-five to thirty pounds, and its flesh is much esteemed. The *Little Bustard* (*O. tetrax*) is scarcely half the size of the preceding species, and less widely diffused.

367. Of the *Rhea*, which is peculiar to South America, there are only two well-defined species. By travellers they are called ostriches. One of the species in its natural attitude stands about five feet high; the other is of smaller size. The plumes of these birds are imported into this country, and are often seen fixed in a handle, so as to form dusting-brushes.

368. Of the genus *Dromarius*, the *Emu*, or *New Holland Cassowary*, is the type. It nearly equals the ostrich in bulk, but is lower on the legs, and more thickset in body. Though not an aquatic bird, the emu swims well. There is only one example of the genus *Casuarinus*, and it is a native of Java, Sumatra, and the Moluccas. Its pinions are very small, and concealed beneath the plumage. The beak, instead of being broad and depressed, as in the ostrich, is compressed laterally, and ridged above. The head, which is naked, is surmounted with a horny crest or helmet. The height of this bird when erect is about five feet, and it is very strong. Its food consists of fruits, and tender juicy herbage.

369. The *Apteryx* is limited to New Zealand. It stands about two feet in height. It has merely the rudiments of wings, buried beneath the general plumage of the body; but, like the ostrich, it runs with great swiftness. When chased, it takes refuge in the clefts of rocks, in hollow trees, or in deep holes, which it excavates in the ground. Its food

consists of insects and worms. Night is the season of its activity, and the natives hunt it by torchlight. The skin,



Apteryx.

prepared with the feathers on it, is highly prized by the chiefs as an article of dress.

RASORES.

370. The ORDER *RASORES* (*Scrapers*)—nearly corresponding with the Gallinacæ, or Poultry tribes—consists of land-birds of bulky bodies, generally vegetable, or rather grain-feeders, gregarious in their habits, and readily domesticable. The name of the order is derived from a noted habit which serves them in seeking for food. They furnish man with a considerable amount of savoury and wholesome food, and their fecundity is very great. The majority of them are at once known by their strong thick legs, long necks, short wings, and large ample tails; and the heads of many, especially of the males, are ornamented with elegant crests. The form of the bill is well seen in the common cock; the upper mandible is vaulted, and, at the same time, destitute of any notch; the whole is short and strong, having a peculiarly horny appearance. The wings are muscular, but their feathers have rounded ends; and the breast-bone presents a comparatively small surface for the attachment of the muscles, so that the power of flight is not great. Almost all of them have a large crop, and an extremely muscular gizzard.

371. The *Rasores*, in general, deposit and hatch their eggs on the ground, in a rudely constructed nest of straw; but some of them, which reside in forests, build in trees. Each male usually associates with many females; he takes no part in the construction of the nest or in rearing the young; and these are generally numerous, and able to run about and provide for themselves the moment they quit the shell. When this is the case, the male is larger and more gaily coloured.

than the female. But in the few species which associate in pairs, such as the ptarmigan and partridge, the sexes nearly or quite resemble each other, both in size and colour.

372. The *Rasores* are usually divided into four families—Pheasants, Curassows, Partridges, and Pigeons.

373. The *Phasianidæ* (Pheasant or Fowl family) are distinguished by the shortness of the hind-toe, the presence of spurs on the legs, and the beautiful development of the tail. Overlooking the turkey, they are birds of the Old World. They may be considered as forming the type of the order. It is in the hotter parts of India that the most brilliantly coloured birds of this family present themselves in greatest numbers.

374. The *Pheasant*, which again may be regarded as the type of the family, derives its name from the Phasis, a river of Colchis, in Asia Minor, from which district it was first introduced into Europe. Several very handsome species abound in different parts of Asia. Among these, one of the most remarkable is the *Argus pheasant*, inhabiting Sumatra and the south-east of Asia. The wings are large, and are covered with eye-like spots, which give a very remarkable appearance to the bird. There is a large poultry-bird in New Holland, which has been sometimes placed among the vultures, but which certainly belongs to this order. This is the *Vultur*: its chief point of resemblance to the vultures is its bald neck; it has also some affinity with the next group, especially in the absence of spurs and the size of the hind-toe.



Peacock.

375. The *Peacock* is a native of the forests of India. Its beautiful tail, or rather train (for the proper tail exists

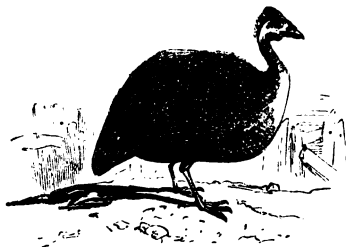
underneath), has made this bird a favourite in the ornamental grounds connected with English country mansions. Alexander the Great found the peacock flying in great numbers in India, and introduced it into Europe, where at first it was shewn for money as a curiosity. The plumage of the *Impeyan*, also a native of the north of India, resembles that of the humming-birds upon a large scale; it can only be compared to the most refulgent hues of variously coloured and finely polished metals.

376. Our well-known domestic poultry, the *Common Cock* and *Hen*, are supposed to have originated in the Indian Archipelago, and to have been introduced at a still earlier period into



Domestic Fowls.

Europe. Their usefulness and general habits are too familiar to require description. The *Turkeys* are the only representatives of this group in the New World, whence they were brought by the early discoverers, and are now quite naturalised in Europe. A more splendid species than the common one



Guinea-fowl.

has been latterly discovered in the Bay of Honduras. The *Guinea-fowl* is originally a native of Africa, where it lives in

large flocks, in the neighbourhood of marshes. Its noisy and querulous disposition renders it troublesome in poultry-yards, although its flesh is excellent.

377. With this family must be classed a genus of birds recently discovered in Australia, and named *Megapodidae*, on account of the size of their feet. These birds equal the turkey in size, are adorned with a crest, and have strong rasorial claws. According to Mr Gould, they do not incubate, but deposit their eggs in mounds composed of earth and vegetable matter, and by the natural heat engendered in these masses the eggs are hatched.

378. The *Curassows* (*Cracidae*), which are restricted to America, are distinguished by the hind-toe being so much developed as to give some power of perching. They offer a remarkable contrast, in their plain colours, to the brilliant plumage of the Asiatic races, which occur in nearly the same parallels of latitude. They are equally capable of domestication with the fowls; and their flesh is of excellent quality. The *Curassows* are about the size of a turkey, and are handsome birds, having the head adorned with crests of long, narrow, erectable feathers, curled at the tips. They commonly perch upon trees. The *Guans* are still more arboreal in their habits. So many varieties of colour are found among them, that it is difficult to trace the limits of the different species. The *Hoazin* is a South American bird, which derives its subsistence almost exclusively from foliage, and chiefly from the leaves of a species of arum growing in marshy places. The toes, unlike those of all other gallinaceous birds, are destitute of any connecting membrane.

379. The *Tetraonidae* (Partridge or Grouse tribe) are all of them wild birds, inhabiting uncultivated grounds in the colder climates of Europe, Asia, and North America. They are distinguished by a short hind-toe, a short tail, and comparatively dull plumage. The grouse, black-cock, and ptarmigan, abound in the Highlands of Scotland; and as the objects of a favourite amusement, give a value to much ground which would otherwise be nearly useless. They feed chiefly on the seeds of wild-plants. The largest species of grouse is the *Capercaillie*, or *Cock of the Woods*, once abundant in Scotland, and still so in Norway. It feeds on pine-shoots, and grows to the size of a turkey. Nearly all the grouse have the toes and legs more or less covered with soft feathers—a character which disappears in the *Partridges*, an extensive group, scattered in nearly all parts of the Old World, but unknown in the New. In the *Quails*, we have the miniature resemblance of partridges, but the tail is so short as to be nearly imperceptible.

There is in tropical America a singular race of birds, called *Tinamous* by the Brazilians; they have scarcely any tail;



Black-cock.

the body is thick, and the whole appearance reminds us of a pigmy bustard. These birds live among herbage, and feed upon fruits and insects. Their flesh forms an excellent article of food.

380. The family of *Columbidae*, containing a large number of elegant and lovely birds, appears much isolated from the rest, being rather adapted for perching than for scraping. Although it is particularly numerous, and spread over every part of the world, there is no difficulty in distinguishing its members from all other birds. One of their chief peculiarities is the *double* dilatation of the crop, which expands on each side of the gullet; and the young are fed with grain disgorged from this receptacle by the parent, and impregnated with a secretion which it forms. These birds live invariably in pairs; they nestle in trees or in the holes of rocks, and lay but few eggs, though they breed often. This family includes the whole of the well-known tribe of *Pigeons* and *Doves*. Some of the tropical species are of considerable size, and of very rich plumage. The *Common Dovecot-pigeon* is probably derived from the *Rock-pigeon*, which naturally breeds principally among the sea-cliffs, and but sparingly inland. But the *Ringed-pigeon* is of a different stock; and though it chiefly frequents the districts cultivated by man, it resists his nearer approach. The *Carrier-pigeon* is not a distinct species, but

only a variety of the common one which has undergone a particular training; and it is probable that other varieties might



Carrier-pigeon.

be similarly trained. Advantage is taken of their fondness for home: being carried out in a basket to a short distance, and then let go, they generally return directly thither; the distance is gradually increased to a few miles, and then to a much greater extent. By means of these birds, intelligence has been conveyed eighty miles in three hours.

381. It is proper here to notice an extinct species of fowl which has attracted much of the attention of naturalists,



Dodo.

and is now believed to have been allied to the pigeon tribe. The *Dodo* existed in the island of Mauritius till the time

of Charles II., and we only know of it now from the descriptions of voyagers, and certain fragments which have happened to be preserved. It was a bulky bird, of heavy figure, with imperfect wings, and only a small bunch of feathers in the usual situation of the tail; a large, strong, curved beak; and legs and feet like those of a turkey. It is supposed to have been particularly adapted to feed on the nuts and seeds of the great forests in which it lived. Mr Strickland considers it as having been, in its mature form, very much like what other birds are in their early state—as it were ‘a permanent nestling, covered with down instead of feathers, and with the wings and tail so short, as to be utterly unsubservient to flight.’

RAPTORES.

382. In strong contrast to the gentle and vegetable-feeding rasorial tribes is the ORDER RAPTORES, birds designed to subsist entirely on the weaker animals of their own and other classes, and therefore generally large and powerful, with a formidable armature, consisting of a strong-hooked beak, and talons more or less retractile. Such of this order as are designed to catch living prey, are also of great strength and swiftness of flight. Contrary to the usual rule, the female is larger than the male. The raptorial tribes, as compared with others, are not numerous, either as species or individuals; they form pairs, live solitarily, and do not breed large families. They may be arranged in three groups—the Falcons, Vultures, and Owls.

383. The *Falconidæ* (Falcon tribe) exhibit the perfection of the order, and correspond very closely in their general habits, and the adaptations of structure to them, with the feline tribe among the Carnivora. Their bodies are of moderate size; their forms light but powerful; their flight graceful; and their courage very great. They are technically distinguished from the vultures, by a notch or tooth on the upper mandible, and by the acuteness and strong curve of their talons, which, like those of the cat tribe, are retractile. The members of this family are almost universally diffused over the earth's surface, some species of them existing wherever there is a sufficient expanse of land to supply them with food. Their plumage is destitute of a bright or gay assemblage of colours, but is nevertheless in many instances peculiarly elegant. The plumage of the young bird, however, is very different from that of the adult, which it is long in attaining; and when first

hatched, the young falcon, like a new-born kitten, is blind and feeble.

384. The *Falconidae* have been commonly divided into the *Noble* and *Ignoble*; the latter not being susceptible of training to the (so-called) noble sport of falconry. The Noble division comprehends the *Falcons Proper*, which are distinguished from the rest by the size of the tooth on the mandible, and by the power of their wings, which are long and pointed. They are the most courageous of all the family in proportion



Peregrine Falcon.

to their size, and are specially adapted to pursue and bring down their prey whilst it is on the wing. From the peculiar construction of their wings, it is not easy for them to rise directly into the air; and their forward flight, in a calm state of the atmosphere, is very oblique. When they wish to rise directly, they fly against the wind, which raises them as it would a paper-kite. A large number of species are known in Europe. The ignoble falcons have less powerful wings, which are shaped like those of the true falcons, with the tips obliquely cut off; the tooth on the bill is less strongly marked, and is often reduced to a mere festoon.

385. The *Eagles* may probably be considered as ranking next to the falcons. They are the largest and most powerful of the whole group, and pursue and destroy quadrupeds as well as birds. They are distinguished from all other *Raptores* by having the legs and feet feathered quite down to the toes.

They usually build their nests in lofty and secluded situations, especially among mountains and precipices, and resist with



Golden Eagle.

great courage any attack upon their young. A large number of species, varying considerably in size, exist in Europe, and many others in America. Some of the English ones are no larger than the buzzards, which are nearly allied to them, and may be regarded in their habits, as in their size, as eagles in miniature. They reside in forests, building high in trees, and descending from the top upon their prey. They destroy much game, and are an especial pest to rabbit-warrens.

386. The *Hawks* are also nearly allied to the falcons, and some of them have been employed in pursuit of game, upon which, however, they stoop obliquely and not perpendicularly. The tooth on the bill is reduced to a kind of festoon, towards the middle of its margin, but the shape of the bill, in other respects, is the same as in the falcons, being short, high, and curved from the base; the wings are also more rounded, but not so much cut at the ends as those of the eagles. The *Kites* have comparatively short feet and feeble claws, and they are much less courageous than the rest of the family. They are distinguished by their long wings and forked tail, by which

their flight is rendered swift and easy, but it is less powerful than that of other Raptores. The common kite of this country has the power of hovering, balanced on its wings, for a longer time than any other known bird. It principally feeds on reptiles.

387. A few species of this family, mostly included among the *Ospreys* and *Ernes*—both of which, but especially the last, are nearly allied to the eagle—are aquatic in their habits, living upon the sea-shore, and subsisting chiefly or exclusively upon fish. They are at once distinguished by the roughness of the under surface of the foot, which assists them in holding their slippery prey; and the *Ospreys* are also able to turn backwards the outer toe, and oppose it to the rest, so as much to increase the grasping power of the foot.

388. The Genus *Circina* (Harriers) have a facial ruff, the feathers of which approach in structure to those of the owls.



Harrier.

Three species are found in Britain—the Ring-tailed Harrier, Montagu's Harrier, and the Moor or Marsh Harrier.

389. Family *Strigidae* (Owls) fulfil during the night the same office which the bolder hunting-falcons perform in the open day, and serve to keep in check the numbers of those small mammals to which nature has also allotted a nightly season. They also take birds from their nests, or snatch them from their roosting-place. For their mode of life, which is chiefly nocturnal, their organs are perfectly adapted. Their eyes are so formed as to perceive an object even amidst the gloom of night; their ears are calculated to collect and concentrate the faintest undulations of sound; and their wings are

constructed for a noiseless flight, so that they steal unheard upon their prey. In the daytime, they occupy the dark recesses of the forest, wooded rocks, and ivy-mantled towers. Owls, in ancient times, from their appearance of imperturbable gravity, were regarded by some as the emblems of Wisdom. The Egyptians represented Minerva under the form of an owl; and the coin of the Athenians, who considered themselves under the especial protection of that goddess, was stamped with its image. This family consists of only one genus, *Strix*, which is usually divided into two sections—Horned or Eared Owls, and Smooth-headed Owls; the former having a tuft of long feathers on each side of the forehead, and the latter being destitute of those appendages.

390. The *Great Eagle Owl* (*S. bubo*) furnishes an example of the Horned Owl. It is the largest of the tribe, being nearly two feet in length, and from five to six in the expanse of its wings. It is chiefly an inhabitant of the mountainous districts of Northern Europe, but is seldom seen in Britain. It is destructive to grouse, hares, and fawns. This species builds on rocks or on lofty trees.



Barn Owl.

391. Of the Smooth-headed species, the *Barn Owl* (*S. flammea*) may be given as an example. It is more common in this country than any other kind of owl. Its food consists chiefly of mice and small birds, which it swallows whole,

without any attempt to tear them in pieces with its claws. The bones and other indigestible parts are afterwards disgorged in small pellets.

392. Family *Vulturidæ* (Vultures) are characterised by a long, straight, and slender beak, curved only at the extremity,



King Vulture.

and by having a greater or less proportion of the head and sometimes of the neck denuded of feathers. The power of their claws does not correspond to the bulk of their body. Their food consists chiefly of dead carcasses and offal, with which they often gorge themselves to such a degree, that they are reduced to a state of stupidity. In hot latitudes, where they chiefly abound, they are of great service in consuming putrefying bodies, which would otherwise infect the air, and spread pestilence in the neighbourhood. No sooner is an animal dead, than its carcass is surrounded by numbers of these birds, which suddenly appear, coming from all quarters, in situations where not one had just before been seen. In some towns of America, they are kept in the market-places, to devour and clear away the offal; and in India, penalties are inflicted on their disturbers.

393. This family consists of five genera—*Gypætus*, Vulture Proper, *Sarcoramphus*, *Gypogéranus*, and *Pernopterus*, severally represented by the Lamb Vulture, the Griffon, the Condor, the Secretary Vulture, and the Neophron, which are the only species we shall notice.

394. The *Lamb Vulture* (*Gypætus barbatus*), or *Bearded*

Vulture, the largest of the European birds of prey, measures upwards of four feet from beak to tail, and nine or ten feet in the expanse of its wings. This species, which is the *Lammergeyer* of the Swiss and German Alps, closely resembles the eagle in appearance as well as habits. It has the same confident and upright bearing, and it seeks a living prey as



Lammergeyer.

readily as carrion. The *Griffon* (*Golden Vulture* or *V. cinereus*) is common in the Alps and Pyrenees, and species of it are found in all the mountainous regions of Africa and of Southern Asia. It nearly equals the Lamb Vulture in size, and is similar to it in habits.

395. *Sarcoramphus* (the Condor), the king of the vulture tribe, is peculiar to the Andes. The extent of its wings when expanded is from ten to twelve feet. Borne on these wide-spread pinions, the *Condor* ascends higher than any other bird, being sometimes found at an elevation of 10,000 or 15,000 feet above the level of the ocean. The species of this

genus partake both of the bold ferocity of the eagle and the carrion-feeding propensities of the vulture.



Condor.

396. *Gypogéranus* (the Common Secretary Vulture), in the lengthening of its legs and neck, together with its short



Secretary.

and strong talons, presents a conformation adapted to destroy

and devour poisonous reptiles, upon which it chiefly subsists, although it does not reject lizards or insects. Species of this vulture inhabit the Cape of Good Hope, the Gambia Coast, and the Philippine Islands. It has been called the *Secretary*, from the feathers at its ear presenting the appearance of a pen.

397. The *Neophron Percnopterus* is common in the northern parts of Africa. In Egypt, it is called by Europeans, *Pharaoh's Hen*. The species of this vulture, which are of comparatively small size, subsist entirely upon carrion.

INSESSORES.

398. ORDER INSESSORES (*Perching-birds*) comprehends an immense number of species, which spend a large portion of their time on the wing, but at intervals rest on trees or elsewhere, possessing therefore short and slender legs, with feet fitted generally by three long fore-claws, and a hind one to clasp any slender object. They are, generally speaking, mixed feeders; some, however, being more given to animal food than others, and furnished accordingly with bills and claws more allied to those of the Raptores. Many are distinguished by their finely coloured plumage; others, by their powers of singing; and there are some which display a surprising sagacity, with singular powers of imitation. As a rule, the females are smaller, less brilliant in plumage, and less melodious than the males.

399. The Perching-birds are divided into four groups, each distinguished by some noted external feature connected with their habits.

400. Group *Coniostres*, so called from having a simple conical beak, may be considered as typical of the order, being the most miscellaneous feeders. Their feet, moreover, are adapted for the greatest variety of purposes, being equally well fitted for walking the ground as for grasping the branches of trees. The group is constituted of five families—Crows, Starlings, Finches, Hornbills, and Crossbills.

401. Family *Corvidæ*.—Of this, the *Common Crows* are the most characteristic examples, as they combine the general characters of the class in a greater degree than any other birds. In every climate habitable by man these birds are found; they are constructed for powerful and continued flight, as well as for walking firmly upon the earth; they feed indiscriminately on animals or vegetables, and when pressed by hunger, do not refuse carrion; their smell is remarkably acute. They are bold but wary, live in common societies, and possess great courage; when domesticated, they possess a power of imitating

the human voice nearly equal to that of the parrot; and, like it, shew signs of greater intelligence than is found in the rest of the class. Under the general term *Crow*, are included the *Raven*, which is the largest of European perching-birds, and which is bold enough occasionally to carry off poultry; the *Corby Crow*, which is very destructive to eggs and young game; the *Rook*, which chiefly feeds on insects, and especially devours the grubs of the coleoptera, though it occasionally eats grain if its proper food be scarce; the *Hooded Crow*, which feeds upon mollusks, &c., on the sea-shore; and the *Jackdaw*.



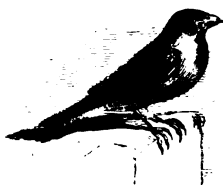
Jackdaw.

The last is a familiar bird, inhabiting deserted buildings, steeples, and high towers, and easily tamed, but troublesome on account of its propensity to secrete any small article of value that comes in its way. The *Magpies* are nearly allied to the Crows; as are also the *Jays*, which live principally, however, in woods, and feed on acorns, &c. The *Nutcrackers* also belong to this family; their habits in many respects resemble those of the woodpeckers; they climb trees, and perforate their bark, and devour all sorts of fruits and insects, as well as small birds.

402. The *Sturnidae* are best known by the *European Starling*; the family seems like a smaller race of crows, which they nearly resemble in manners and structure, while much weaker. They seek their food generally upon the ground, are social in their habits, and seem to prefer plains frequented by cattle, on the parasites of which animals they love to feed. They are easily tamed, and may be taught to speak, or to

imitate the song of other birds. A great number of species, in different parts of the world, are referred to this family; amongst them may be specially noticed the *Icterinæ*, or *Hang-nests* of South America, which build long purse-shaped nests, suspended from the slender branches of lofty trees, in order, as is understood, to save their young from becoming the prey of serpents; they feed on fruits and beetles, and are never seen upon the ground. The African *Buphaga*, or *Ox-pecker*, is also remarkable for its habit of perching upon the backs of cattle, to which it clings by its sharp claws, compressing the skin, to force out the larvæ of gadflies, &c., on which it feeds.

403. The *Fringillidæ* (Finches) are the smallest of this group of Perching-birds, and are readily known by the shortness and strength of their conical bills. They subsist generally on grain. The number of species is very great; and some among them are everywhere diffused. The *Sparrow*, for example, is in this country found wherever there is a human habitation, generally building its nest under our eaves, and feeding either upon our grain-fields, or on the crumbs that fall from our tables. The Chaffinches, Linnets, Goldfinches, Bullfinches, and Larks,



Sparrow.



Goldfinch.

are other species of the *Fringillidæ* well known in this country. To the same genus with the linnet belongs the *Canary-bird*,

originally brought from the Canary Islands, but now so abundantly bred in captivity, that it is difficult to assign the original colour from the numerous varieties that present themselves. The *Chaffinch* is a bird of cold climates: one species, known as the *Brambling*, visits Britain only in the winter; and another nestles in the high Alps, and descends only in the depth of winter to the secondary ranges. To this family belong the *Weaver-birds* of tropical climates, which are celebrated for the remarkable construction of their nests, composed of blades of grass interwoven together; in one species, a number of individuals unite their nests into a large single mass, divided into numerous compartments. The *Whidas*, or *Widow-birds*, resemble the linnets; but have a remarkable development of feathers in the tail at the breeding-season, being destitute of it at other times. The *Grosbeaks*, of which one British species is known as the *Greenfinch*, are remarkable for the thickness of their beaks, which are exactly conical, and with which they pick out the kernels on which they feed. The *Virginian Nightingale* is nearly allied to the grosbeak. To this family also belong the *Buntings*, granivorous birds, of which several species have been seen in Britain; and the *Larks*, so well known for their habit of continuing their song

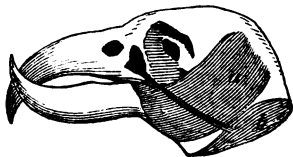


Lark.

whilst ascending to great heights in the air. With the exception of one species, these last are peculiar to the Eastern hemisphere. The hind-toe, and the claw which terminates it, are greatly prolonged; the feet are altogether formed for walking on the ground, where, indeed, these birds construct their nests.

404. The *Bucerida* (Hornbills) are birds of the Old World, resembling crows in most respects, but distinguished by the peculiarity from which they take their name—namely, a huge excrescence upon the upper beak, not solid, except in one species, but composed of a fragile net-work of bony fibres. The use of this curious appendage is unknown.

405. The *Loxiadae* (Crossbills) are distinguished by a strong curvature of the mandibles, causing their tips to pass each other—a peculiarity which gives them a great advantage in extracting their favourite food, the seeds of the pine-cones.



Bill of Crossbill.

a and *b*, muscles which move it.

406. Group *Dentirostres* embraces an extensive variety of genera, all characterised by their more or less carnivorous habits, and the presence of a notch, called a tooth, upon the upper mandible, designed to serve for killing—the peculiarity from which the name of the group is derived. The mouth is, moreover, protected on each side by bristles, which defend the soft parts during the struggles of the prey. The group is divided into five families—Shrikes, Fly-catchers, Thrushes, Warblers, and Chatterers; the two first of which are the most addicted to preying habits, while the last are comparatively vegetable-feeders.

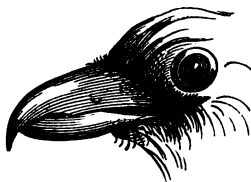
407. The *Shrikes*, *Laniadae* (from *lanius*, a butcher), are the typical family of the *Dentirostres*. They kill their prey, which



Shrike.

consists chiefly of small birds, mice, shrews, and frogs, by repeated blows of the bill on the head; and after satisfying their hunger, they hang up what remains on a thorn, to be devoured at their leisure. From this habit, they have obtained

the name of *Butcher-bird*. They are about the size of a black-bird, are gregarious in their habits, and their flight is irregular and precipitate. Their natural cry is shrill; but they are remarkable for their power of imitating the songs of such wild-birds as live in their vicinity. Most of the species are merely periodical visitors of the British Isles. *L. excubitor* is the type.



Bill of Shrike.

408. The Fly-catchers, *Todidæ*, or *Muscicapidæ* (from *musca*, a fly, and *capiō*, I take), are characterised by a depressed beak, armed with bristles at the base. They are generally migratory, as all fly-catchers must be, to obtain their food. The two following species only are recognised as visiting Britain:—The *Red Fly-catcher* or *Red Finch*



Spotted Fly-catcher.

(*M. atricapilla*) visits England in the summer months. Its length is about five inches, and the extent of its wings eight. The *Gray-spotted Fly-catcher* (*M. grisola*) is common enough in England, but rarely visits Scotland. This species arrives early in May, and frequents plantations, orchards, and gardens. When watching for its prey, it sits on one of the outer branches of a tree, from which it descends upon a passing insect, regaining immediately its station.

409. Of the *Thrushes* (*Merulidæ*), the *Blackbird* (*Turdus*

merula) may serve as the type; it is about eleven inches in length. Its food consists of fruit, insects, and caterpillars. The male Blackbird has a glossy black plumage, while the upper part of the body of the female is of a blackish brown; the bill being of an orange-yellow colour, and the feet brown. This beautiful and well-known songster is among the first to welcome the return of spring.

410. The *Common Thrush* (Mavis or Song-thrush) and *Fieldfare* are also well known and characteristic examples. These, as well as the *Missel-thrush*, *Redwing*, *Ring-thrush*, &c., are closely allied species of the same genus, of which the other species are distributed over the whole globe. The *Mocking-birds*, on the other hand, which probably stand



Mocking-bird.

unrivalled for their powers of voice, and have the singular gift of imitating the cries of many other birds, are restricted to America: some of them approximate to the shrikes in their habits. The *Orioles* are also nearly allied to the thrushes; they are migratory birds, having longer wings than their congeners, and chiefly frequent the south of Europe, where they build very curious hanging-nests. The celebrated *Buhl-buhl* of the East is one of a group of thrushes remarkable for the brilliancy of their plumage and for their powers of song. A few species of this family have somewhat aquatic habits. One of these is the *Dipper*, or *Water-ousel*, which immerses its whole body without swimming, and walks about in a jerking, fluttering manner at the bottom of streams, in search of the small animals which constitute its food.

411. The *Warblers* (*Sylviadæ*) are the most musical of European birds, but are inferior to many others in the brightness of their colours. Those best known are the Nightingale, the Red-breast, and the Willow Wren.



Wren.

412. The *Nightingale* (*Sylvia luscinia*) is a migratory bird, which visits England in the beginning of April, and leaves it in August, rarely getting so far



Nightingale.

north as Scotland. It builds on trees, and does not sing till the young ones are hatched. The notes which it then gives forth have in all ages been a theme of admiration. 'To hear it on one of those balmy mornings in May, when every leaf is freshness and every breath young perfume, is worth more than a whole musical festival.' The Nightingale is the largest of the

Warblers, its length being about seven inches, and the extent of its wings ten or eleven inches.

413. The *Robin* (*S. rubecula*) is a constant inhabitant of Britain, and the greater part of the European continent. It is a beautiful little bird, and has a sweet song. It is useful in gardens and orchards, as its food consists principally of worms



Wagtail.

and caterpillars. In summer it is shy, but in winter it draws near the abodes of man. The *Wagtail* (*Motacilla*) is another

member of this family which attracts general attention, on account of the habit from which it derives its name, and its sprightly airy movements, as it flits about searching for insects near shallow waters.

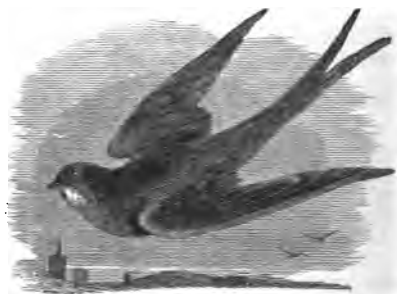
414. The *Chatterers*, *Ampelidæ* (ἀμπελιδες, a vine), are characterised by a straight convex beak, and an uncommon width of gape. The *Bohemian Chatterer*, or *Wax-wing*, is a species well known in Europe, Asia, and America. It is less than a thrush, and is crested on the head. Its general colour is a vinish gray, with a black throat.

415. The group *Fissirostres* derive that name from having their beak deeply cleft—a peculiarity which gives a wide gape, and fits these birds for catching insects on the wing. The head of the goat-sucker is here presented as illustrating this peculiarity. The group have great powers of flight, with comparatively small and weak feet. Some have the outer toe nearly as long as the middle one, and were hence called by Cuvier *Syndactyli*.



Head of Goat-sucker.

416. The family *Hirundinidæ* (Swallows) are well-known



Swift.

summer visitors of the British Islands, Africa being understood

to be their chief winter resort. They are remarkable for being so much on the wing in search of food, and for their vivid, irregular movements in flying. The hind-toe is directed very much forward, and all the four are armed with strong claws, giving the animal the power of clinging to the faces of perpendicular rocks and buildings. The *Martin* is a familiar



Martin.

bird, building a curious mud nest in the sheltered angles of buildings. The *Swift* is a species possessing more enduring powers of flight than the swallow, which is often seen on its long journeys to fall wearied upon the surface of the sea. In the Indian Archipelago is a small species of swallow, which forms its nest of a kind of sea-weed, which it macerates in its stomach, and arranges in layers. These nests are used in China to make a kind of soup, much prized as a delicacy.

417. The *Goat-suckers*, or *Night Jars* (*Caprimulgidae*), fly in the dusk, and feed on moths and beetles, which they seize on the wing. Like the owls, they cannot bear the glare of day. In Britain, we have only one species, which visits in the beginning of summer, and leaves us in the end of September. It is chiefly found on furze of commons, wild bushy heaths, and broken hilly ground, covered with ferns, especially in the neighbourhood of thickets and woods. It is about eleven inches in length, and twenty-three in the expanse of its wings. It derives its name from the absurd belief of the ancients,

that it injured the teats of goats in its attempts to suck them.



Goat-sucker.

418. The *Bee-eaters* (*Meropidae*) are said to be extensively distributed in Africa, where they migrate in small flocks to the countries along the northern shores of the Mediterranean. They feed on insects, especially bees, which they pursue much in the manner of swallows. To this family also belong the *Rollers*, most of which are natives of the East, but of which one species inhabits Europe. They are in some respects intermediate between the swallows and bee-eaters. One species is stated to perch and watch for prey on the horn of the rhinoceros, giving notice to that animal of the approach of the hunter.



King-fisher.

419. The *King-fishers* (*Halcyonidae*) are generally natives of the warmer regions of the globe. They live upon aquatic

insects and small fish, and may be seen perching on the stump of some decayed tree which overhangs a stream, watching the minnows, on which they dart with unerring aim. They then return to their perch, beat their victim to death, and swallow it. The only species indigenous to Britain is a beautiful little bird, rather larger than the lark. The *Todies* (*Todidae*) are small American birds, nearly allied to the former family.

420. The group of *Climbing-birds* (*Scansores*) comprehends four families of considerably diverse character, but having one remarkable peculiarity in common—namely, an arrangement of the toes, by which two are directed forward and two backward, so as to fit the animal especially for climbing. They are not good walkers or fliers, and, careless of nest-building, are content to rear their young in the hollows of trees. It may be said that of all birds they are the most arboreal.

421. Family *Picidae* (Woodpeckers).—This kind of bird is well fitted for climbing trees, not only by its *zygodactyle* feet, but by the pointed feathers of its tail, which, being inserted in the bark, form a rest for it as it ascends. It is furnished with a long sharp tongue, which it inserts into the chinks of timber



Woodpecker.

in search of insects, transfixing them with its barbed point, and further securing them by means of a viscid substance with

which it is covered. At the pairing-season, the Woodpecker communicates with its mate, not by song, as is customary, but by rattling its beak against a dead-branch; from which sound its name has been derived. There are three species constantly resident in Britain—the Green Woodpecker, the Great-spotted Woodpecker, and the Lesser-spotted Woodpecker. The first is sometimes called the *Rain-bird*, because it makes more noise than usual before wet weather. This bird is about thirteen inches in length, and twenty-one in breadth.

422. The *Wryneck* (*Yunc torquilla*) belongs to this family. It is a beautiful summer migrant. In England, it is called the *Cuckoo's Messenger*, because it arrives only two or three days before that bird. Its food consists chiefly of ants. A hole in a tree is generally chosen for nestling.

423. The *Creepers* (*Certhiadae*).—Of these birds, the *Nuthatch* is the only species known in Europe. It is frequently seen during the day running rapidly about, either up or down the trunk or branches of a lofty oak or beech tree. The food of the Nuthatch consists of insects and seeds, particularly acorns and nuts. It procures a supply of insects, such as earwigs and caterpillars, from beneath the old bark of trees, by lifting it up with its wedge-shaped bill. It is remarkable for its instinct in fixing a nut in a chink, while it pierces it with its bill, swinging the whole body as on a pivot to give effect to each stroke.

424. The *Cuckoos* (*Cuculidae*).—The *Common Cuckoo* (*Cuculus canorus*) is the type. It is a migratory bird, arriving in this country about the end of April. Its cry, 'cuckoo,' from



Cuckoo.

which it derives its name, is well known. In size, the bird is nearly equal to a pigeon, and it is of an ash-gray colour. Its

food consists of caterpillars, insects, and small fruit. The Cuckoo has no nest of its own, nor does it hatch its own eggs, but deposits them in the nests of other birds, such as the Water-wagtail, by which they are reared; and as it deposits but one egg in each nest, the process of rearing the progeny may be carried on by several foster-parents at once. In its flight, it is usually attended by small birds, chiefly the Meadow-pipits.

425. The *Toucans* (*Ramphastidæ*) have bills of enormous size, nearly as large as the body itself. They are gregarious in their habits. Their food consists of fruit and insects, and the



Toucan.

eggs and young of other birds. In feeding, they throw each morsel into the air, and catch it in its descent. This family is peculiar to the warm regions of America. They are in general black, with lively colours on the throat, breast, and croup.

426. The *Psittacidæ* (Parrots) constitute a family which is very widely diffused through the torrid zone in both new and old continents, and is scarcely found beyond it. It contains a large number of species, each of which has its peculiar locality, the short wings of these birds not enabling them to traverse large tracts of sea. They correspond with the other *Scansores* in little else than the structure of the foot, and this is formed rather for grasping than for climbing. It is also used for conveying food to the mouth, a peculiarity nowhere else seen but in the goat-suckers. Their beak is stout, hard, and solid, curved and pointed very much as in

the diurnal birds of prey. Their jaws are set in motion by a greater variety of muscles than are found in other birds. The tongue is thick, fleshy, and rounded; and the larynx, or organ of voice, is also more complicated—by which peculiarities they gain their facility of imitating the human voice as well as other sounds. Their voice in a state of nature, however, is loud and harsh. They use their crooked bills in clambering up trees, and nestle in hollow trunks. They subsist upon the succulent parts of vegetables, especially bulbs and fruits. They are distinguished from the rest of the scansorial birds by their intelligence and docility—qualities in which some species are unsurpassed by any members of the class.

427. The *Parrot tribe*, nearly all of which are adorned with gorgeous colours, has been divided, chiefly from a regard to peculiarities of plumage, into many minor groups, the limits of which, however, are mostly arbitrary. The *True Parrots* are square-tailed, and have no crests. They are found in both the old and new continents, and are more easily taught to speak than others of the family. The *Cockatoos* are also



Cockatoos.

square-tailed, but have crests upon their heads. The white ones inhabit the Indian Archipelago and Australia; they are singularly gentle and affectionate, and easily maintained in captivity in Europe. The *Love-birds* are a beautiful group, found in both continents, nearly allied to the parrots, but of

diminutive size. The *Parroquets* have a long-pointed tail, and chiefly inhabit the Asiatic continent and islands, and Australia. An American species of Parroquet is the only member of the parrot tribe found to the northward of the Tropic of Cancer. The *Macaws* are long-tailed American species, which exceed all the rest in size, and are superbly



Macaw.

coloured. The *Lories* are Oriental species, with square tails and dense soft plumage, the colours of which are glowing in the highest degree; the beak is in general comparatively feeble, and they feed upon the juices of flowers and the pulp of the softest fruits.

428. The group *TENUIROSTRES* (Slender-billed Birds) are generally of small size and great beauty of plumage, chiefly confined to tropical countries. By their slender beaks and long tongue, forked or divided into filaments at the extremity, they are specially fitted to live upon the juices of flowers; in which respect, as well as in their fine colouring, they remind

us of certain families of insects. Many of them, however, are also insectivorous. The feet are very short and delicate.

429. The *Meliphagidæ* (Honey-suckers) are distinguished by their notched bill; their tongue is terminated by a bunch of delicate filaments; and the hind-toe is so strong and robust, that it serves as a support to the bird during the process of feeding. This group is chiefly confined to Australia, where its members abound in great variety of form, and where they find a never-failing support in the luxuriant vegetation of that country.

430. The *Paradisidæ* (Birds of Paradise) are among the largest of the *Tenuirostres*, and seem to live, like the rest of the order, chiefly upon soft vegetable substances. They are confined to New Guinea and the neighbouring islands; and for a long time no specimens were obtained but such as had been deprived by the natives of their legs, whence it was at one time supposed that they were destitute of limbs, and supported themselves entirely on their airy plumes. The extraordinary development of their feathery appendages is well known; but



Bird of Paradise.

of the purpose these serve in their economy, no plausible account has been given. The very restricted locality of these birds, and the savageness of the people who inhabit it, have prevented naturalists from obtaining much knowledge of their habits. They are partly supported upon insects.

431. The *Trochilidæ* (Humming-bird tribe), so celebrated for

the metallic lustre of their plumage, and particularly for the gem-like brilliancy of some of their feathers, have within their long slender beak a tongue divided almost to the base into two filaments or threads. These filaments are *not* tubular, as sometimes described, but flattened. The organ is employed for diving into flowers and sucking their juices; but it is not improbable that it also serves for catching insects, since it is unquestionable that, like others of the order, the Humming-birds are partly insectivorous. When hovering over flowers,



Humming-bird.

these birds balance themselves in the air by a rapid motion of the wings, and it is by this movement that the *humming* sound is produced from which they take their name. The flight of these birds, the smallest of the order, is so rapid as frequently to elude the eye. They live solitarily; defend their nests with courage, attacking with their needle-like bills the eyes of intruders, which makes these minute creatures truly formidable; and they fight with each other desperately.

432. This family is exclusively confined to America, and, with few exceptions, to the southern part of that continent and the adjacent West Indian islands. More than one hundred and seventy species are at present known, and others are constantly being discovered. The smallest of them, when plucked, are less than a large humble-bee; and one only,

which is much larger than any others as yet known, nearly equals the common swift in size. This bird is also one of the dullest coloured, and its general resemblance to the swifts is very manifest.

433. The *Cinnyridæ* (Sun-birds) represent the Humming-birds in the eastern continent. They are closely allied to the *Trochilidæ* in general structure, and in the mode of obtaining their food, but their tongue is not so deeply divided. They are small birds, and the males have the most brilliant colours, rivalling those of the humming-birds during the breeding-season; but the garb of the female, and of the male at other parts of the year, is much more dull. The bill is not so straight as in the *Trochilidæ*, and the legs less delicate, so that a connection between that and other families is evident through this one. The *Sun-birds* are of a lively disposition, and sing agreeably.

434. The *Promeropidæ* (Hoopoes) are also restricted to the Old World; one species, the *Common Hoopoe*, annually visits Europe in company with the Bee-eaters, and other swallow-like



Hoopoe.

birds; but, unlike its congeners, it seeks its food on the ground. Most of the tribe, however, feed upon the juices of flowers and succulent fruits, and their plumage possesses metallic lustre. The feet, as well as the tongue, are very short.

CLASS MAMMALIA, OR SUCK-GIVING ANIMALS.

435. The MAMMALIA agree with birds in possessing a complete double circulation and warm blood; and with reptiles in breathing air, and generally living on the surface of the earth; but they differ from all other vertebrata, not so much in producing their young alive (which is the case in a few species of reptiles and fishes), as in their subsequent nourishment of them by suckling—from which circumstance the name is derived. This class is placed at the head of the Animal Kingdom, not only as being the one to which Man belongs, but also because it is that which enjoys the most numerous faculties, the most delicate sensations, the most varied powers of motion; and in which all the different faculties seem combined to produce a more perfect degree of intelligence; the one most fertile in resources, most susceptible of perfection, and least the slave of instinct. Although principally adapted to motion on the ground, we find one tribe possessed of the power of rising into the air like birds, and another formed to inhabit the water like fishes; but both these agree with other Mammalia in all essential characters, and differ very widely from the classes with which their habits seem to associate them. To the Mammalia is confined the protection of the body by hair or fur; the nearest approach to it being in the hair-like feathers of a few species of birds. But the presence of this covering is by no means universal in the Mammalia.

436. Naturalists, in seeking to classify the Mammalia, have to look chiefly to those indications which the teeth, extremities, and other external characters furnish, regarding the general habits and dispositions of the several animals. Thus, keeping out of view minor distinctions, the possession of sharp fangs and claws is a clear mark of carnivorous habits; flat-topped teeth and hoofs, equally a proof of a gentle and herbivorous character. The flapper of the whale shews a fitness for progression in the sea; the development of a wing on the hand of the bat, a design that the animal should make its way through the air. Other distinctions are found in the advance of the animals in their general development, forming still broader grounds of classification.

437. A minor portion of the Mammalia produce their young in an immature state—indeed scarcely alive—and these attain a comparatively low permanent condition, their bodily

structure presenting many points of affinity to birds and reptiles. In this division, which are chiefly localised in Australia, there are two groups.

MONOTREMATA.

438. The MONOTREMATA—so named because, as in birds, the excretory openings are united into one—are exclusively Australian. There are two species, the *Echidna*, or Spiny Ant-eater, and the *Ornithorhynchus*, or Duck-billed Platypus.

439. The *Spiny Ant-eater* (*E. hystrix*) is rather larger than the common hedgehog, to which it bears some resemblance, being armed with spines on the upper part of the body, and having a prolonged snout. It frequents sandy places, and burrows in the ground. Its food consists of ants and other insects, which it entraps with its long and adhesive tongue. The *Ornithorhynchus* derives this name, now universally adopted by naturalists, from the bird-like snout of the animal (*ὄρνις*, a bird, and *ῥύγχος*, a beak). 'The similarity of its jaws to those of a bird,' says Swainson, 'is so great, that upon its first discovery, it was strongly suspected the specimen sent to Europe was a deception, practised by some



Ornithorhynchus.

cunning fellow on the credulity of naturalists by ingrafting the bill of a duck upon the skull of a quadruped.' By the colonists, it is called the Water-mole—an appellation suggested by its aquatic habits, combined with some slight resemblance which it bears to the common European mole. The *ornithorhynchus* is about eighteen inches in length, and clothed with a dense fur. It frequents the tranquil parts of rivers, in the banks of which it burrows, and it obtains its food by the capture of small aquatic animals.

MARSUPIALIA.

440. The MARSUPIALIA exhibit a nearer approach to the full mammalian character. The name, signifying Pouched Animals (Lat. *Marsupium*, a purse), is derived from the remarkable provision which is made for the continued nourishment of the young after their immature birth. The new-born imperfect offspring attaches itself to the teats of the parent, and remains fixed there until it has acquired a degree of development comparable to that with which other animals are born. The skin of the abdomen of the parent is so disposed as to form a pouch, in which these imperfect young are protected, and into which, long after they can walk, they retire for shelter on the apprehension of danger. It is remarkable that, notwithstanding the general, and usually very striking, resemblance of the species to each other, they differ as much in the teeth, the digestive organs, and the feet, as do the other orders of Mammalia from each other; and indeed it may be said that some of these other orders are *represented* each by a strongly analogous group, in the Marsupialia.

441. The geographic range of this order is extremely peculiar. With the exception of the Opossums, which inhabit America, its species are at present almost confined to Australia and the neighbouring countries, where they constitute, with the Monotremata, almost the only mammiferous animals. It is remarkable, also, that from the remains found in secondary rocks, they appear to have existed at a much earlier geological period than the superior Mammalia, and to have been more extensively diffused over the earth's surface than at present.

442. The *Marsupialia* may be divided into the following families, which have been named according to their predominating food. These terms must not, however, be regarded as strictly indicating the food of the several species contained in each group, but only their general tendency to select for their support the substances implied by those designations. 1. *Sarcophaga*, or Flesh-eaters, such as the *Dasyurus*. These have three kinds of teeth,* long canines, and a simple stomach like that of the Carnivora. 2. *Entomophaga*, or Insect-eaters, such as the *Opossum*. These have also three kinds of teeth and a simple stomach, but a more complex intestinal canal: they are parallel with the Insectivora. 3. *Carpophaga*, or Fruit-eaters, as the *Phalangers*, or Flying-opossums. These have large and long incisors in both jaws, the canines sometimes

* The front teeth are termed incisors, or cutters; those next to the incisors, are canine, or dog-teeth; and those at the sides of the jaws, molars, or grinders.

absent, and a more complicated intestinal canal. They may perhaps be regarded as representing the frugivorous Bats. 4. *Poephaga*, or Grass-eaters, as the *Kangaroos*. These have long anterior incisors, the canines only present in the upper jaw, or altogether wanting, and a complex intestinal canal like that of other herbivorous Mammalia. 5. *Rhizophaga*, or Root-eaters, as the *Wombat*. These, in the structure of the teeth and alimentary canal, are true Rodentia.

443. All the existing species of the first family, *Sarcophaga*, are confined to New Holland and Van Diemen's Land. These animals vary in size, from that of a small wolf to that of a mouse. The larger ones possess considerable ferocity, destroying sheep, and even invading houses; others attack poultry, of which they suck the blood; and the smallest are partly insectivorous, and live on trees, thus shewing an approach to the next family. The names *Hyæna*, *Devil*, *Wild-cat*, &c., applied by the colonists to these animals, sufficiently indicate their general correspondence in habit with those of the order Carnivora.

444. Of the second family, *Entomophaga*, some are adapted to live on the ground, and even to burrow beneath the surface, whilst others ascend trees in search of their food. To this latter group belongs the *Opossum* tribe, which is extensively diffused through America. These have a long and prehensile tail; and the hinder thumbs are long, and effectively opposable to the other digits. They are fetid and nocturnal animals, of slow gait, nestling upon trees, where they pursue birds, insects, &c., without rejecting fruit. The *Virginian Opossum* is nearly



Virginian Opossum.

the size of a cat. It enters the villages at night, and attacks poultry, devouring also their eggs. One species frequents the marshes of the sea-coast, where it feeds chiefly on crabs. In

a part of this tribe no pouch exists, but only a vestige of it, in the form of a fold of skin on each side of the abdomen. In these, the mother supports her young by entwining her tail with theirs.

445. The animals of the third family, *Carpophaga*, are peculiarly adapted to live among the trees on which they seek their food. Some species, in their general form, and in the prehensile character of their tails, approach the opossums. Such are the *Couscous* of the Molucca Islands; these feed on insects and fruit. At the sight of a man, they are said to suspend themselves by the tail; and if he gazes at them steadily for some time, they fall through lassitude. The most remarkable species, however, is the *Petaurus* of New Holland, which much resembles the flying-squirrels. Like these, it possesses an extension of the skin on each side of the body, between the anterior and posterior legs; and a flattened bushy tail, by the help of which it can take leaps of considerable length. Like the bats, or the flying-lemur, to which it may be compared, it is a nocturnal animal, remaining during the day nestled in the hollows of trees; but it becomes animated as night advances, skimming through the air, supported by its lateral expansions, half-leaping, half-flying from branch to branch, and feeding upon leaves and insects. It would seem that, whilst in motion, it has some power of altering and directing its course. Another animal belonging to this group, the *Phascogale*, or *Koala*, a native of New Holland, is as large as a moderate-sized dog. It has the gait and carriage of a young bear, and passes its life upon trees, and in dens or holes which it hollows at their feet. The female carries her young for a long time on her back.

446. The family of *Poeploga* consists chiefly of the *Kangaroos* and the *Kangaroo-rat*, all of which are inhabitants of New Holland and the neighbouring countries. The Kangaroos are remarkable for the enormous length of their hinder feet, whence their generic name, *Macropus* (long-footed), is derived. The hind-legs and tail are also very largely developed; whilst the fore-legs and feet are very small. From this great inequality in the size of the limbs, they advance on all-fours very slowly; but they can make immense leaps with the hind-legs, the tail probably assisting them. These are furnished with one large nail, almost like a hoof, which is a powerful weapon of offence and defence; for, supporting itself upon one leg and its tail, the animal can inflict a very severe blow with the leg which is at liberty. The largest species is sometimes six feet in height, having the bulk of a sheep, and weighing 140 pounds. Its flesh is used as food by the New Hollanders, and is described as being somewhat like venison. The Kangaroo

grazes, like ruminant animals, and is the only inhabitant of New Holland that at all represents that tribe. The young ones reside in the maternal pouch until they are able to graze for themselves, which they effect by stretching out the neck from their domicile while the mother herself is feeding. Several species exist, diminishing in size to less than that of a hare.



Great Kangaroo.

The Kangaroo-rat connects this family with the preceding one ; it is about the size of a small rabbit.

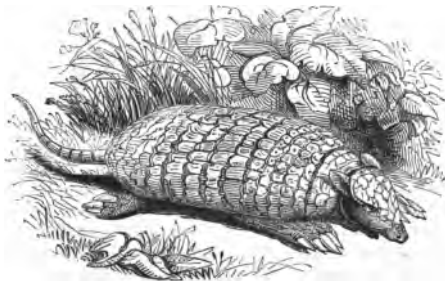
447. The last family, *Rhizophaga*, contains only one species at present known—the *Phascolomys Wombat*. This animal is about the size of a badger, by which name it is known to the colonists, and is a native of Van Diemen's Land. It is a sluggish animal, with a flattened head and body. It burrows in the forests and low grounds; hiding itself in natural crevices at higher elevations. When attacked, it grunts like a pig ; it bites hard, and is furious when much provoked. As already mentioned, the organisation of its digestive system corresponds closely with that of the Rodentia ; and from what is known of its food, it seems to find its support, like the animals of that order, in the tougher kind of vegetable substances.

448. Another subdivision of the Mammalia is marked by higher characters than the preceding, but still must be placed

in a position somewhat below the highest, the animals composing it being generally diminutive and weak, with a lower style of dentition, and less complex brain, than those which are next to be considered. In this division are comprised three orders—*Edentata*, *Insectivora*, and *Rodentia*.

EDENTATA.

449. ORDER EDENTATA take their name from the peculiarity common to all, of an entire absence of the incisor teeth. One large group, *Myrmecophaga*, or Ant-eaters, are specially fitted for their insectivorous mode of life, by the long-pointed form of their muzzle and the strength of their feet, the extremities of their toes being nearly included in large nails, which approach in character to hoofs. They are peculiar to the warm and temperate regions of South America. Some species are covered with hair; others with scales, which they elevate when irritated. They possess a long thread-like tongue, always covered with a gluey saliva, and which forms an admirable instrument for catching such burrowing insects as the ants. Another group, the *Armadillos*, are remarkable for the dense



Armadillo.

armour of hard scales with which they are covered. They subsist partly on vegetables, and partly on insects and carcasses. This group is also confined to South America. They are generally about the size of a cat, but one species is three feet in length. Ant-eaters and Armadillos are considered, as of all the true viviparous mammalia, approaching, in the structure of their brain, most nearly to birds.

450. The *Tardigrada*, or Sloths, are a group of animals considerably different from the above in all respects but their want of the fore-teeth. They are herbivorous, inhabiting the

forests between Mexico and Brazil, the largest not exceeding a fox in bulk. They live on trees, which they never leave,



Sloth.

unless compelled through force or accident ; and what is extraordinary, their most common posture is that of suspension from the branches, which they clasp with their arms and legs. In this attitude, they sleep, rest, and move from tree to tree. For this mode of life they are admirably adapted, their arms being twice as long as their hinder extremities ; and they are by no means so slow as they are said to have been by early naturalists, who had seen them only in a state of confinement.

451. Fossil remains of two very large animals of this family have lately been discovered in America—the *Megatherium* and the *Megalonyx*—nearly equalling the elephant in size. From the structure of their teeth, it has been inferred that they were leaf-eating animals, but with a short neck, unfitting them to reach the highest branches. It is difficult to ascertain the manner in which they got at their food. Professor Owen supposes, that they first cleared away the earth from the roots of a tree with their claws, and then seating themselves on their hinder extremities, and grasping the trunk with their fore-feet, heaved it to and fro till they prostrated it to the ground, and then regaled themselves on its leaves.

INSECTIVORA.

452. ORDER INSECTIVORA are small animals, subsisting chiefly on insects and vegetable substances. They are all nocturnal and subterranean in their habits, and most of them spend the winter in a state of sleep. From the shortness of their legs, their movements are necessarily slow. They are divided into three families—*Hedgehogs*, *Moles*, and *Shrews*.

453. *Erinaceadæ* (Hedgehogs).—These animals are called Hedgehogs, because they prefer the roots of hedges as their hiding-places, and from a superficial resemblance which they bear to pigs. Their teeth shew that they are omnivorous. Nature has provided them with a bristly coat of armour, which by strong cutaneous muscles they can draw over every part of the body, or every part which is accessible, so as effectually to protect themselves from their enemies. They live on fruit and the eggs of small birds, and are torpid in winter.

454. *Talpidae* (Moles) live chiefly under ground, feeding on



Mole.

insects, worms, and roots. Their feet are admirably adapted to their subterranean mode of life. From the smallness of their eyes, which are scarcely perceptible, it was long considered that the Moles were blind; but it is now ascertained that they are by no means deficient in the sense of sight. Moles have no external ears; but, from the tympanum being large, their sense of hearing is nevertheless very acute.

455. *Soricidæ* (Shrews) are small animals, having soft hair. Some of the species are among the smallest of mammalia. The Common Shrew measures only two inches in length. The food of these animals consists of worms and insects. They burrow in the ground, seldom appearing abroad except towards night. This family is composed of *Shrews*, *Amphibious Shrews*, and *Water Shrews*.

RODENTIA.

456. ORDER RODENTIA take their name from their gnawing habits, for which they are fitted by having the two canine teeth close together (incisors being wanting), the pairs in the several jaws working against each other. These teeth are constantly wearing away, but as constantly growing; so that when one is lost or broken, its opposite, having nothing to wear it down, becomes developed to an enormous extent. The body is heavier in the rear than in the foreparts, so that rodent animals leap rather than run.

457. The *Rodentia* may be divided into seven families, the technical distinctions between which are founded upon minute particulars in the structure of the cranium and of the lower jaw. 1. *Sciuridæ*, or Squirrel tribe, comprehending a large number of light and agile animals, chiefly distinguished by their long bushy tails, and by their adaptation to a residence in trees, and to live upon their produce. 2. *Muridæ*, or Rat tribe. 3. *Castoridæ*, or Beaver tribe, including the Voles, Lemmings, &c. 4. *Hystriidæ*, or Porcupine tribe. 5. *Cavidæ*, or Guinea-pig tribe. 6. *Chinchillidæ*, the Chinchilla tribe. 7. *Leporidæ*, the Hare tribe. The rodents of the fourth, fifth, and seventh families are destitute of the clavicle, which those of the three first and the sixth possess.



Squirrel.

458. Of the family *Sciuridæ*, the *Common Squirrel* of this

country may be taken as a characteristic illustration; and its form and habits are sufficiently well known to render particular description unnecessary. It lives entirely upon vegetable food, in search of which it leaps with great agility from branch to branch. In taking these leaps, when it is once thrown off by an effort of its long and powerful hind-legs, it is in a measure sustained by the horizontal spreading of its limbs and bushy tail, the hairs of which are directed laterally, so as to resemble a feather. In the *Pteromys*, or Flying-squirrel, this sustaining power is much increased by an extension of the skin of the flank between the fore and hind legs, which serves as a parachute. The *Marmots* are allied to the



Marmot.

squirrels in the number and structure of their teeth, which are partly adapted, however, to insect food. In other respects, they are almost the reverse of squirrels, being heavy, with short limbs and a moderate-sized tail, and living on the ground, or even in burrows beneath it. They are connected with the former tribe, however, by an elegant little animal termed the *Ground-squirrel*, partaking of the habits of both; this is a native of Eastern Europe. A very remarkable kind of Marmot is one known in North America by the name of the *Prairie-dog*, or *Barking-squirrel*, on account of its voice, which resembles the bark of a small dog. It lives in great troops, in immense burrows. More allied to the squirrels in the size of their tail and active habits, but differing in their dentition, are the *Dormice*, the structure of whose teeth shews them to approximate to the next family. They chiefly subsist on vegetable food; but some species of them attack small birds. All the members of this family pass the winter in cold climates in a state

of lethargy, which is most profound in the Marmots and Dormice.

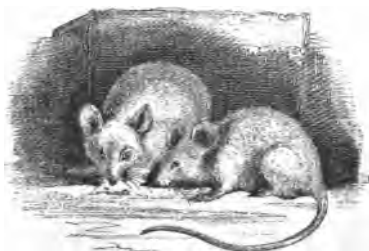
459. The family of *Muridæ* contains the smallest, and at the same time the most prolific, of the Mammalia. No undomesticated animals are better known than *Mice* and *Rats*. The *Brown* (commonly, but erroneously, called the Norway) *Rat* made its first appearance in Paris about the middle of the



Rat.

eighteenth century, and in England not many years earlier. It is believed to have originally come from Persia, where it lives in extensive burrows. It is said to have arrived in Astracan by swimming across the Volga, after an earthquake, in 1727. Its astonishing fecundity, its omnivorous habits, the secrecy of its retreats, and the ingenious devices to which it has recourse, either to retain its existing place of abode, or to migrate to a more favourable situation, all conduce to keep up its almost overwhelming numbers. Where a plentiful supply of animal food is afforded them, rats will feed exclusively upon it. The Brown Rat is now speedily replacing the *Black* or *Old English Rat*, which is becoming rather a rare animal in this country, and which, from its smaller size, is an unequal match for the usurper. There is reason to believe, however, that even this is not a native of England, and that it was introduced from France about the middle of the sixteenth century. From Europe these two rats—which infest vessels equally with houses—have been sent to America, the islands of the Pacific, and many other places, in some of which they have now become a serious inconvenience. The only strictly indigenous British species of *Muridæ* are the *Harvest-mouse* and *Long-tailed Field-mouse*, both of them very beautiful little animals, and very interesting to the naturalist, although highly injurious to the agriculturist. A great number of species exist

in various parts of the world, which do not differ widely from each other.



Mouſe.

460. The *Hamsters* have teeth nearly similar to those of the rats, but their tails, instead of being long and scaly, are short and hairy, and their cheeks are hollowed into pouches, in which they can stow away a large quantity of grain for transport to their nests. They abound in the sandy plains of the north-east of Europe, from Germany to Siberia, and are very injurious, from the quantity of grain they hoard up in their extensive and intricate burrows. They have more ferocity than most of the order, and will attack any animal that comes in their way. They are believed to feed upon birds as well as upon vegetables. Allied to the rats in its dentition, and having also some points of resemblance to dormice, is the curious genus *Dipus*, or Jerboa, the general form of whose body, as well as its mode of progression, is very similar to that of the kangaroo. The enormous length of the hind-feet occasioned them to be designated Two-footed Rats by the ancients; whence their present generic name is derived.

461. Of the *Castoridae*, the *Beaver* is probably the type; but this family contains many genera having a close resemblance to the rats. The Beaver is distinguished from all other rodents by its horizontally flattened tail, which is of a nearly oval form, and covered with scales. The hind-feet are webbed, by means of which and the tail these animals obtain considerable swimming powers. They chiefly subsist on bark and other hard substances, and can fell trees of considerable size, of which they use the bark and twigs as food, employing the stems in the construction of their remarkable habitations. The flattened tail is employed by them as a kind of trowel, with

which they plaster the walls of their houses. The Beavers are connected with the previous family by the *Arvicolæ*, or Voles,



Beaver.

many of which bear a strong general resemblance to rats, but differ in their dentition. Most of them are partly aquatic in their habits; such is the *Common Water-rat* of this country, the food of which, like that of the Beaver, is (contrary to the general opinion) almost exclusively vegetable. To this group also belong the *Lemmings*, or Scandinavian Rats, which are remarkable for their occasional migrations in immense bodies. They are stated to advance in a straight line, regardless of rivers and mountains; and while no insurmountable obstacle impedes their progress, they devastate the country through which they pass. Most of this family lay up a winter store of food, upon which they subsist in the intervals of sleep, and they do not go abroad during that season.

462. The animals which are characteristic forms of the family *Hystriidae*, are recognised at the first glance by the stiff and pointed quills with which they are armed, somewhat similar to those of the hedgehogs, but usually much larger. Besides the *Porcupines* and their allies, however, to which this description more particularly applies, this family contains several forms which connect it with the two preceding. The name porcupine is corrupted from the French *porc-épine*, a term expressive of the pig-like aspect and grunting voice of these animals, as well as of their spiny covering. They live in burrows, and have very much the habits of rabbits. The best known species inhabits the south of Italy, Sicily, and Spain. It is nearly the largest of the Rodentia, measuring almost three

feet in length. There is an American genus nearly allied to the true porcupine, which has a long prehensile tail, like that of the opossums, and lives in trees.



Porcupine.

463. The next family, that of *Cavidæ*, contains the largest sized animals of this order, although, when compared with ordinary quadrupeds, they would be termed small. They are naturally restricted to tropical America, where they replace the hares and rabbits of cold climates. But the *Guinea-pig* is now extremely common in Europe, and is quite domesticated. The *Capybara* is an inhabitant of the sides of nearly all the great rivers of South America, and is the largest known animal of the order, being about three feet in length, and of the size of the Siamese pig. It has a large, thick, and blunt muzzle, is destitute even of the rudiments of a tail, and is scantily covered with bristly hairs. Its semi-aquatic habits are shewn by the webbing of the feet. By this structure it can both swim and dive with much activity. Upon land it makes but little progress, running badly, and generally diving in the water to avoid danger. It lives in small societies, and seems to be a nocturnal feeder. Another of the *Cavidæ* is the *Agouti*, which is an inhabitant of the Antilles and tropical America. It is about the same size as the European hare, and, like it, possesses very long hind-legs, by which it runs, or rather leaps, with considerable swiftness. In regard to its food, however, and its manner of feeding, it rather resembles the squirrel; preferring nuts to herbage, and sitting upon its haunches whilst eating. When angry, it stamps with the fore-feet, grunts like a young pig, and erects the bristly hair of the crupper in the manner of a porcupine.

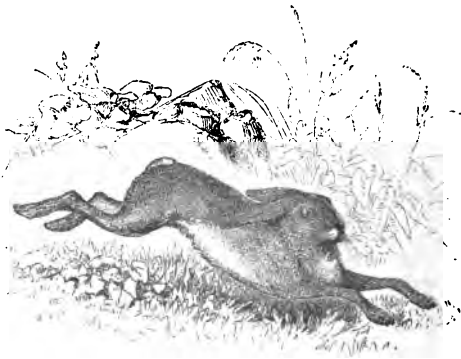
464. The animals of the small family *Chinchillidæ* were, until recently, known only by their skins, which constitute an important article of commerce. In their general organisation,



Chinchilla.

they seem intermediate between the cavies and rabbits, but differ from both of them in possessing clavicles. They are all natives of South America, chiefly inhabiting the range of the Andes, and they live socially in extensive burrows.

465. The *Leporidae* constitute the last family of the Rodentia, and are distinguished from the rest by the presence of two small incisors behind the rodent teeth. The form and habits



Hare.

of the typical genus, *Lepus*, are sufficiently well known in the *Hare* and *Rabbit* of this country. A large number of species

exist in the different parts of the northern hemisphere, and some are inhabitants of the arctic regions. There is one species of this country, in which the brown fur, that forms its summer coat, changes to white at the approach of winter. The hare is a ruminating animal, though without the peculiarly



Rabbit.

complex stomach of the Ruminantia. The *Lagomys*, or Rat-hare, is a very interesting genus, allied to the hare, but having nearly perfect clavicles, and the fore-legs almost as long as the hind. It is chiefly remarkable for the mode in which it lays up its store of winter provisions. It lives in solitude, or in small societies, in the mountainous parts of Siberia, and hollows out its burrow amongst stones and in the clefts of rocks, and sometimes in the holes of trees. About the middle of August, these animals collect their store of winter provender, which is formed of select herbs, and these they bring near their habitation, and spread them out to dry like hay. In September, they build up the fodder they have collected into heaps or stacks, which they place under the rocks, or in other places sheltered from the rain or snow. Where many of them have laboured together, their stacks are sometimes as high as a man, and more than eight feet in diameter. These stacks, which consist of the choicest and most succulent herbs, are often pilfered by the natives of that part of Siberia for the subsistence of their cattle and horses. A subterranean gallery leads from the burrow of the *lagomys*, beneath the mass of hay, so that neither frost nor snow can interrupt the animal's communication with it.

466. The remaining orders of Mammalia may be placed on a higher level, not merely in point of size and generally of strength, but in the character of their organisation. We are first called upon to notice a cluster of animals which are usually associated in one order, on account of their being fitted to spend the whole or most of their time in the sea, but which may more properly be divided into two. The aquatic mammalia were, till no distant date, universally regarded as fish, the external figure and medium of existence being alone looked to, and no one having observed that the animals breathe the atmosphere, suckle their young, and are in many other respects different from the finny tribes.

CETACEA.

467. ORDER CETACEA (Whales) are in general bulky animals, resembling fish in their external figure, and entirely fitted for living in the sea. Some are herbivorous; others, carnivorous. The head is usually of enormous comparative size, and fitted closely to the body, yet not without the seven cervical vertebrae which form an invariable feature of mammalian animals. The anterior extremities are fashioned into paddles, for progressive motion; while the hind extremities are united into what appears as a tail. This so-called tail, unlike that of the fish, is disposed horizontally, thus forming a powerful oar for enabling the animal to rise from the depths of the ocean to take breath on the surface, or to dive suddenly below. Under the naked apparent skin of the whales, is what is now ascertained to be the true skin, composed of a thick mesh of fibrous substance, filled out with fat or blubber; forming at once an elastic padding, to enable the animal to resist the pressure of the sea at great depths, and a comfortable wrapping, to save its natural heat from escaping into the cold element amidst which it lives. As is well known, the whales are chiefly sought for and captured, for the sake of the oil produced by this peculiar coating. Another feature of the whales, is the situation of the nostrils terminating at the crown of the head, and forming spiracles through which they project the sea-water, mingled with their breath.

468. The herbivorous Cetacea are named *Manatidæ*, from the resemblance of their anterior extremities to hands. They live upon submarine plants, and the herbage which grows on the banks of rivers. They seldom exceed fifteen feet in length. The *Dugongs* of the Indian Archipelago and Red Sea are the most remarkable species. It is supposed that the many fabulous stories regarding Mermaids have taken their rise from certain species of the *Manatidæ*, in which the head and face,

when seen alone above the water, strongly recall the human lineaments.

469. The *Balenidæ* attain the length of seventy feet, of which the head always forms a large part. In the mouth, instead of teeth, is an apparatus which, in the circumstances, serves the animal more effectually for the supply of its food. This is a series of horny plates, arranged round the jaws, and forming simply a *strainer*. The animal, having taken in a huge mouthful of water, containing cuttle-fishes and other small animals, expels the water through this apparatus, leaving the prey behind, which is then swallowed. This peculiar construction has a parallel in some of the duck tribes, whose bills are furnished with a somewhat similar apparatus. From this *baleen*, as it is called, is derived the article in common use under the name of *whalebone*. It gives a generic name to the group of animals possessing it. The *Common Whale* (*Balæna mysticetus*) is an inhabitant of the Arctic seas, and its capture, as is well known, is the subject of a great trade. The sailors transfix it with a harpoon, to which a line is attached, and when it rises exhausted to the surface, they kill it, and extract the blubber. The great danger of this business is from the tail of the whale, which is quite able to upset a



Whale Harpooning.

boat, or even to cut it in two. The *Rorqual* is another species, in the same seas, different chiefly in being longer, with a more slender body.

470. The *Physeteridæ* (Cachelot or Spermaceti Whales) are

inhabitants of the Southern Ocean. They are distinguished by the bulk of their heads, in which a surprising quantity of fat is lodged.

471. The *Delphinidæ* are smaller animals, generally seen in droves, and remarkable for their active and lively movements in the water. The *Dolphin*, from which the group is named,



Dolphin.

has been the subject of many fabulous stories. It was in use for food throughout the middle ages, partly in consequence of its being allowed, as a supposed fish, to be eaten during Lent. The *Porpoises* are the most familiar on our shores, to which they often come in pursuit of herrings. One remarkable species of the *Delphinidæ* is the *Narwhal*, or Sea-unicorn, in which one of the front teeth is developed to the surprising length of six feet, forming, of course, a most formidable weapon. The *Narwhal* is, however, comparatively inoffensive.

PHOCIDÆ.

472. ORDER PHOCIDÆ comprises the remainder of the aquatic mammalia. By Cuvier they were associated with the carnaria of the land, to which, it must be owned, they make a near approach. They are, in general, much smaller animals than the Cetacea, from which they differ, too, in being fitted for a partial residence on land. Their four membraned feet form powerful oars for swimming, and can also be used in clambering along the rocks. They are covered with a short close fur, sitting flat upon the skin. They pass the greater part of their time in the water, which they only quit to bask in the sunshine, and to suckle their young.

473. Of the two genera, the *Seals* and the *Morses*, which this family contains, the former presents the least departure from the general type of the order. It possesses all three kinds of teeth; but the canines are not particularly large, and the molars are neither adapted for shearing nor for

grinding the food, but are furnished with angular points adapted to keep hold of and crush the slippery prey. The head of the seal resembles that of a dog, presenting the same mild and expressive physiognomy. These animals seem to possess considerable intelligence; they are easily tamed, and become much attached to their feeder. They subsist on fish, which they always devour in the water, closing the nostrils by a kind of valve. Seals of various kinds are extensively



Greenland Seal.

scattered over the polar regions of both hemispheres, becoming scarcer in the temperate zone. They are occasionally seen on the coast of south Britain, but are more abundant on the north of Scotland. The fur-seal of the South Seas is extremely abundant in some localities; for a period of fifty years, not less than 1,200,000 skins were annually obtained from a single island.



Morse.

474. The *Walrus* (also called Morse, Sea-cow, Sea-horse) resembles the seal in the general form of the body and limbs,

but differs considerably in the head and teeth. The lower jaw has neither incisors nor canines, and is compressed laterally to pass between two enormous canines or tusks, which issue from the upper one, and are directed downwards, sometimes attaining a length of two feet. These seem to be used by the animal in hooking up the sea-weeds on which it partly feeds. The Morse is a very bulky creature, exceeding the largest bull in size, and attaining the length of twenty feet. It is an inhabitant of all parts of the arctic seas, usually assembling in large numbers; and individuals have occasionally visited the British shores.

475. Two orders of the remaining Mammalia are distinguished by having the extremities serviceable only for support, and terminating in *hoofs*. They are destitute of clavicles, and may be generally described as vegetable feeders. These two orders are classed together as *Ungulata*, or Hoofed Animals. The first order we shall notice is the

RUMINANTIA.

476. The ORDER RUMINANTIA is perhaps the most natural and best determined of the mammalian class, for all the species which compose it seem constructed, as it were, upon the same model, the camels alone presenting any considerable exceptions to the general characters of the group. The first of these characters is the entire absence of incisor teeth from the upper jaw; whilst the lower appears to possess eight: of these, however, the two outer ones are really canines, which have taken the form of incisors, so that the number of the true incisors is six, as in the other viviparous mammalia. The molars are almost always six in number, both above and below, and have their crowns marked with two double crescentic ridges of enamel, which aid in masticating the food. The feet are each terminated by two toes and two hoofs, which present a flat surface to each other, appearing as though a single hoof had been cleft; hence the names that have been applied to these animals of cloven-footed, &c. Behind the hoof there are always two small spurs, which are the vestiges of lateral toes.

477. The name of the order intimates the singular faculty possessed by these animals of masticating their food a second time, or 'chewing the cud.' This faculty depends on the structure of their stomachs, which are four in number. The food, which is cropped by the incisor teeth, is swallowed almost without mastication, and is moistened in the stomach; and

after being compressed into little pellets or *cuds*, is returned to the mouth, to be rechewed while the animal is at rest. When this operation has been performed, the food is transmitted to the true digestive stomach. This remarkable provision has a very interesting adaptation to the general structure and characters of these animals. The Ruminantia, taken as a group, are timid, and destitute of powerful means of defence against their foes. They rather seek their safety in flight when attacked. Their food, consisting chiefly of the grasses of various kinds, requires to be thoroughly masticated before it can be properly digested. When feeding on the pastures they frequent, they are liable to many alarms; and if they were compelled to spend a considerable time in masticating their food before swallowing it, they would often be in danger of starvation, by being obliged to leave their pasture before their wants were supplied. But by their power of subsequent rumination, they are enabled to dispense almost entirely with the first mastication, and to feed with comparative quickness. They convey a store of food into the first stomach or paunch, as the monkey into its cheek-pouches; and then, retiring to a secure place, they prepare it for digestion at their leisure.

478. The whole structure of these animals corresponds with the account just given of their habits. Their legs are long in proportion to their body, and the spinal column is very flexible; both which conditions are favourable to great activity of motion. They are endowed with a very acute sense of smell, which seems to be their guide in the selection of their food. Their ears are placed far back, and are very movable; and these are well adapted to catch sounds from behind, so as to warn the animals of danger whilst feeding. The eyes are placed at the sides of the head, and the pupil is in the form of a horizontal oblong; so that the range of vision along the surface of the earth is very great, and the animals can easily look behind them when pursued. Their means of defence consists in the use of their horns to gore their enemy, and of their hind-feet to kick; but it is only when peculiarly courageous, or in defence of their young, that single animals of this order will act on the offensive, or stand on the defensive, against others of proportional size and strength.

479. The Ruminants, of all animals, are those which are most useful to man. They supply him with a large proportion of his animal food. Some serve him as beasts of burden; others furnish him with their milk, their tallow, hair, leather, horns, and other useful products.

480. The great resemblance which exists among the very

numerous members of this order, renders the distribution of them into families, each characterised by some important peculiarity, a matter of some difficulty. These subdivisions are, probably, best formed from the character of the horns, which are possessed by the males of all the species in their natural state, excepting such as (like the camel) connect this order with other groups. The horns are essentially bony prominences from the forepart of the skull. In some Ruminants, commonly termed *cattle*—such as oxen, sheep, goats, and antelopes—these prominences are covered with an elastic sheath, formed as it were of agglutinated hair, which continues to increase by layers during life. It is to the substance of this sheath that the name of *horn* is commonly applied, whilst the bony support is termed the *core*; this grows during life, and never falls. In the *Giraffe*, again, the bony prominences are covered with a hairy skin, which is continuous with that of the head; and here, too, the bony part of the horn is permanent. But in the *Deer*, these prominences, which are covered for a while with a hairy skin (commonly termed the *velvet*), like the other parts of the head, have at their base a ring of bony tubercles, which periodically enlarge, and compress the nutritive vessels of the horns. These accordingly die, and fall from the skull; and the animal remains defenceless. Others, however, are reproduced, generally larger than before, which are destined to undergo the same fate. These horns, periodically renewed, are usually styled *antlers*.

481. The Ruminants with horny sheaths to the bony prominences, may be divided into three families:—*Antelopidae*, or Antelope tribe, characterised by the lightness of their forms and the activity of their movements, and by the solidity of the bony core;—*Capridae*, or Goat tribe: in these the bony core is partly occupied with cells, and the general form approaches that of the Ox tribe, but the horns are directed upwards and backwards;—*Bovidae*, or Ox tribe: these have the horns directed upwards and forwards; the form is robust, and the movements heavy. The division of the Ruminants in which the horns are periodically cast off, constitutes only one family—that of *Cervidae*, the Stag tribe. Another family, including only the Giraffes, and named *Camelopardae*, is characterised by the shortness and permanence of the horns, which are covered with a skin. Of the Ruminants without horns, there are two distinct families—the *Moschidae*, or Musk Deer, which are remarkable for their elegance and lightness, and differ but little from the rest of the order, save in the absence of horns; and the *Camelidae*, or Camel tribe, which,

in their dentition and in the structure of the extremities, exhibit a transition to the Pachydermata.

482. The family *Antelopidae*, remarkable for the slenderness of form and swiftness of foot of the animals composing it, contains above seventy well-ascertained species, bearing a strong general resemblance to each other. Most of these are natives of Africa; a few species, however, inhabit Asia; a still smaller number exist in America; and one only, the *Chamois*, now remains in Europe. Among these numerous



Chamois.

species, we meet with forms that remind us of the other families of the Ruminantia—the Ox, Goat, Stag, &c. They generally associate in large herds, which migrate together in



Spring-bok Antelope.

search of pastures. A species well known to the colonists of South Africa is the *Spring-bok*; which occasionally visits their

cultivated lands, during seasons of drought, in innumerable herds, causing devastation wherever they pass. Another noted species is the *Gazelle*, celebrated for its beautiful eyes, as indicated by the poet :

‘I never nursed a young gazelle,
To glad me with its soft black eye,’ &c.

They are extremely vigilant and timid ; and the speed of the



Gazelle.

swiftest species surpasses that of every other mammiferous animal. Those which are adapted to live on rocks and



Gnu.

mountains exhibit the most remarkable agility, and fearlessness of those dangers which their habits would seem to involve : they

walk with perfect composure along the giddy brinks of the most awful precipices, climb and descend with wonderful care and precision, and leap up or down to the smallest surface that will contain their collected feet, with perfect firmness; and yet they are so fearful of any supposed enemy, that it is difficult to get within gunshot of them. Allied to the Antelopes is a very curious genus, the *Gnu*, which at first sight seems to be a monstrous being, compounded of parts of different animals. The body and crupper, also the tail, neck, and mane, resemble those of a horse; whilst its horns are like those of the Cape buffalo; and its legs are as slender and light as those of a stag. It inhabits Southern Africa.

483. The family of *Capridæ* is connected with the last by many antelopes which, like the chamois, approach the goats in form. It includes only the *Goats* and *Sheep*. The original stock of the domestic breeds of the former appears to be indigenous to Persia, where it inhabits the mountains in large troops. The goats of Angora, Tibet, &c., celebrated for the fine quality of their hair, are no more than



Goat.

varieties of the common species. The *Ibex*, which inhabits the mountains of the Old World, and especially the Caucasian chain, is distinguished by the size and strength of its horns. It is said that this animal fearlessly precipitates itself down precipices, always falling on its horns, the elasticity of which secures it from injury. The *Sheep* appear to have extremely little real difference from the goats; a large number of races exist, the relation of which to each other is uncertain; and there is doubt as to the original stock of the whole. Of the domestication of this animal, we have an earlier record than

of any other ; and on its use to man, there is no need to enlarge in this place.



Ram.

484. The species of the family *Bovidae*, or Ox tribe, are comparatively few. They are all large animals, with a broad muzzle, heavy and massive body, and stout limbs. Of the original stock of the domestic ox, we have no certainty, since, as in the case of horses, the existing races of wild cattle may have all been descended from those which have been



Bull.

at some period subservient to man. Of all the animals which have been reduced to his service, the ox is, without exception, that to which he is most indebted, for the extent and variety of his means of usefulness. The universal utility of the animal

appears to have been very soon detected; and we find, consequently, that its domestication soon followed that of sheep, and that it is mentioned in the most ancient records as a servant of man, long before either the horse or dog is noticed. The ancient accounts of the *Urus*, or Wild Ox, declare it to have been an animal of great size and fierceness, with large spreading horns; and bones are found in the most recent deposits, both in this country and on the continent, which correspond with that description. Many races or breeds of oxen exist in different parts of the world, which were probably all descendants from one stock, and yet differ considerably from one another. Most of those inhabiting the torrid zone have a lump of fat upon the shoulders, which increases in size in proportion to the abundance of their food. This is especially remarkable in the *Indian* or *Brahmin Bull*, which, being held sacred by the Hindoos,



Brahmin Ox.

is supplied with food in great profusion, and leads an indolent life. When left to themselves, their form changes; they become less bulky and more active, and the hump, in particular, greatly diminishes. Some of the tropical races of oxen are no larger than a hog.

485. Amongst the undomesticated species of this family, which have all a strong general resemblance to each other, and are the most powerful and savage animals of the whole order,

may be noticed the European *Bison*, which was formerly spread over Europe, but is now restricted to Lithuania and the Caucasian region ; the American bison, commonly called *Buffalo*,



Bison.

which inhabits all the temperate parts of North America ; the *Indian Buffalo*, of which there are several different races (in one, the horns include a space of ten feet from tip to tip), of which some have been domesticated ; the *Cape Buffalo*, an



Cape Buffalo.

extremely ferocious animal, with large horns, first directed downwards so as nearly to cover the forehead, inhabiting the

woods of Caffraria ; and the *Musk Ox*, a species inhabiting the coldest regions of North America, with short legs, and long



Musk Ox.

hair reaching the ground, which diffuses more strongly than the rest the musky odour common to the whole genus, and which is particularly noticeable in the European bison.

486. The family *Cervidae*, or Stag tribe, includes, like that of antelopes, a large number of species differing but little amongst each other, very widely diffused over the earth's surface, and easily separated from others by the character of the horns. With the exception of the reindeer, however, the female is destitute of horns, save in a few rare individual cases, analogous to those amongst birds in which the hen assumes the plumage of the cock-bird. This never takes place until the latter part of the animal's life. The substance of the horns, when completely developed, is that of a dense bone, without pores or internal cavity ; their figure varies greatly according to the species, and even in the same individual at different ages. These animals are extremely fleet, and live mostly in forests, where they feed on grass, the leaves and buds of trees, &c.

487. This very extensive genus may be subdivided into sections, according to the form of the antlers. In some species they are wholly or partially flattened. This is the case, for example, with the *Elk*, one of the largest existing species, which lives in troops in the marshy forests of the north of both continents. It is as large as a horse, and sometimes larger. The antlers of the male, at first dagger-shaped, and then divided into narrow slips, assume, at the age of five years, the form of a triangular blade, with tooth-like projections on its outer edge. These increase with age ; so that the horns have at last fourteen branches proceeding from each expanded portion, and weigh

fifty or sixty pounds. To this group also belongs the *Reindeer*, so serviceable to the Laplanders, which is the only species



Reindeer.

properly domesticated, though others are doubtless susceptible of being so. The *Fallow-deer*, now naturalised in this country, but probably introduced from the south of Europe, or even originally a native of Barbary or Western Asia, is another

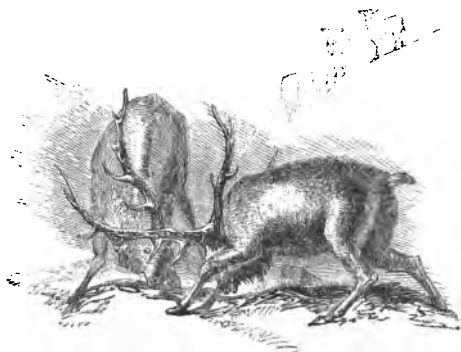


Fallow-deer.

species of this group. The remains of a gigantic species of deer, belonging to the same section, are frequently found in

peat-bogs, and other recent deposits in this country, and more especially in Ireland, whence the name *Irish Elk* has been given it. Judging from specimens of which the greater part of the bones have been discovered, it must have stood more than six feet high, and have been nine feet long; but there is no doubt, from the dimensions of many of the horns which are preserved (one pair measuring thirteen feet between the tips), that this is under the average size of the race.

488. The species with round antlers are more numerous; those of temperate climates change colour, more or less, with the seasons. The Common Stag, or *Red Deer*, is the best known



Red Deer.

of these, being indigenous to the forests of all Europe and of the temperate parts of Asia. The Canadian Stag, or *Wapiti*, the Elk of the Anglo-Americans, is a fourth larger. There is also another species, inhabiting Virginia and the central parts of North America, which is smaller than the European stag, and is known as the *Deer*. A large number of species are indigenous to Central and Southern Asia, of which some have been naturalised elsewhere.

489. Of the family *Camelopardæ*, only one species was for a long time known to exist; but there are probably two, or even three kinds of giraffe, all of which are natives of Africa, mostly frequenting the borders of the deserts. Its remarkable form, depending chiefly on the great length of its neck and fore-legs, is familiar to every one. In its general structure, however, it closely resembles the deer, differing from them in the permanence of the horns. It has also some points

of affinity to the camels, especially in the length of its neck, the existence of callosities, or hard surfaces, on the breast and knees, and the absence of the small spurious hoofs. It is the tallest of all animals, its head being frequently raised eighteen feet from the ground. Its disposition is gentle, and it feeds on leaves; browsing upon the young branches at a height much above that which any other animal can reach, and drawing



Giraffe.

them towards its mouth by its prehensile tongue. It lives in small troops of five or six individuals, and is very timid, although capable of powerfully defending itself by kicking. Notwithstanding the length of its neck, the number of vertebræ which this part contains is no greater than in other Mammalia.

490. The *Moschida*, or Musk Deer, are completely intermediate between the true Deer and the Camel tribe, which last connects the Ruminantia with the Pachydermata. They resemble the ordinary Ruminants in the lightness and elegance of their forms, and in the nimbleness of their movements; and differ chiefly in the absence of horns, and in the projection of the canine tooth on each side of the upper jaw, as in the camels. The name of this group has been derived from the common *Musk*, the males of which secrete the odoriferous substance so called in a small glandular bag. This species is nearly destitute of the tail; and the hairs, which completely cover it, are so coarse and brittle, that they might almost be called spines. It is confined to the mountainous region between Siberia,

China, and Tibet, from which most of the Asiatic rivers descend. Its habits are nocturnal and solitary, and its timidity extreme. The other deer inhabit the warmer parts of Asia and



Musk Deer.

the Eastern Archipelago; they have no musk-pouch. They are the smallest and most elegant of the Ruminantia, and are active and gentle in their habits.

491. The *Camelidæ*, or Camel tribe, approximate to the succeeding order, and especially to the whole-hoofed division of it constituting the Horse tribe, more than do any other Ruminants—to such a degree, indeed, that some naturalists prefer associating them with that group. They have always canines in both jaws, and two of the incisors have also the same pointed shape. The animals of this family are much less elegant in form and graceful in action than the other Ruminants; but their organisation is, equally with theirs, perfectly adapted to the circumstances in which they exist. The family contains two groups—the *Camels* and *Llamas*; the former are restricted to the Old World, and the latter correspond to them in the New.

492. In the true *Camels*, the two toes are united below by a kind of horny sole, almost to their points, which terminate in small hoofs; and there is a soft cushion beneath the foot, by which it bears upon the sandy surface over which it is formed to move. Two species are known—one called the *Bactrian*, or Two-humped Camel, and the other the *Arabian*, or One-humped. Both are completely domesticated, and their utility as beasts of burden is universally known. The first species

is employed chiefly in Central Asia, the latter in Arabia, North Africa, Syria, Persia, &c. The Two-humped Camel is the larger and stronger, being capable of sustaining a burden of above one thousand pounds, and is best adapted for rugged



Bactrian Camel.

ground. The other is the most abstemious, and the best fitted for the sandy desert. The *Dromedary* is merely a lighter variety of it, possessed of greater fleetness and power of



Dromedary.

endurance. The flesh and milk of the camel serve as food, and the hair for the manufacture of cloth. Their humps, principally composed of fat, are provisions of superabundant nutriment, which are gradually absorbed and disappear on the occasion of a scarcity of other food, as is observed at the end

of a long journey. By resting on their callosities, they are enabled to repose on a scorching surface, and their stomachs are adapted to contain a supply of water sufficient for several days.

493. The *Llamas* of South America are much smaller than the camels; they have the two toes quite separate, and are



Llama.

without humps. They were the only beasts of burden possessed by the Peruvians at the time of the conquest. They can only make short journeys, and the largest of the four species known cannot sustain more than 150 pounds. Remains of a fossil species have been lately found, which must have equalled the camel in stature.

PACHYDERMATA.

494. The second of the Ungulated orders is the **PACHYDERMATA**, so called from the thick skin with which most of them are invested. The animals of this order do not ruminate. They may be divided into three sections or groups.

495. Of the first group, *Proboscidea*, the *Elephant* is the only living genus; other species, as the *Mammoth* and *Mastodon*, having become extinct in not very remote times. The varieties yet surviving are animals of huge size, which subsist in the great forests of India and Africa by feeding on the leaves of trees and long grass. The elephant has not a complete hoof, but five toes to each foot, which are only distinct in the skeleton, the whole being enveloped in callous skin, excepting the nails at the extremities. All these animals agreed in possessing a pair of enormous tusks or front teeth, and a very elongated nose or proboscis; and it is probable that this last

organ was formed, as in the elephant, to answer the purposes of a hand—laying hold of large objects by coiling itself round them, and of small by means of the finger-like organ at its extremity. The magnitude of the sockets necessary to hold the tusks, renders the upper jaw so high, that the nostrils, which are prolonged through the trunk, are placed in the skeleton near the top of the face. By means of its trunk, the elephant not only lays hold of its food, but sucks up its drink, which it causes to fill its capacious nostrils, and then discharges into its mouth by bending its trunk. By this admirable organ, the shortness of the neck, rendered



Elephant.

necessary by the weight of the head, is fully compensated. The cavity for the brain by no means corresponds with the external form of the skull; for in order, as it would seem, to give a larger surface for the attachment of the muscles of the trunk, the outer layer of bone is widely separated from the inner, and between the two are a number of large bony cells.

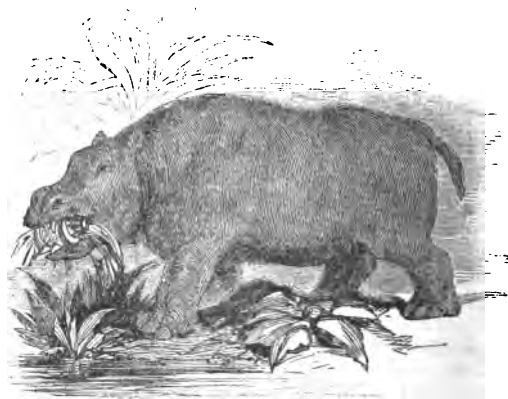
496. In none of the Proboscidea has the lower jaw of the adult any front teeth. The arrangement of the grinders differs in the various species; but in all they are composed of alternating plates of hard *enamel* and softer *bony* matter, cemented together by a third substance, which is termed the *cortical*. These grinders are in constant progress of renewal; but they succeed each other, not by rising from below upwards, as in man, but by being pushed forwards from behind, in proportion as the tooth before each is worn away. The tusks are only

changed once ; but, like the cutting-teeth of the rodents, they are constantly being renewed at the roots. Two species of elephants exist at the present day, both of which inhabit tropical climates—one in Asia, the other in Africa. Remains of the mammoth are chiefly found in the north of America and of Siberia ; and from a nearly perfect specimen, which was discovered frozen in the ice near the mouth of the river Lena, it appears that this species was adapted to live in cold climates—the skin being densely covered with hair of two kinds. The tusks of the elephant serve not only as weapons of offence and defence, but to root up small trees and tear down cross-branches, either to obtain their leaves or to make a passage for the bulky body of the animal through the tangled forest.

497. Of the second group, sometimes called the *True Pachydermata*, the first family is that of *Suidæ*, the Pig kind. It is characterised by the peculiar thickness of the skin, and by the presence of four toes on each foot. They have three sorts of teeth in each jaw ; the canines are usually long, and project forward as tusks ; the anterior molars are more or less narrow and conical, whilst the posterior are tuberculated. The food is principally vegetable, but admits of considerable variation. The domesticated pig is well known to be quite an omnivorous animal. In the true *Pigs*, the foot has two toes furnished with large hoofs, and two much shorter ones that scarcely touch the ground. The *Wild-boar*, which abounds in some parts of the continent of Europe, is well known to be a very ferocious animal ; and the domesticated race which is derived from it, often exhibits indications of the same character. One of the most curious animals of this tribe is the *Babyroussa*, a native of the Indian Archipelago ; the upper canines of which are very long, and grow spirally upwards and backwards. These serve as defensive weapons of a very powerful description, inflicting severe lacerations by an upward stroke of the head. The *Peccaries* of South America want the external toe, and the central ones are partly joined together, as in the Ruminants ; to which the complex structure of their stomachs also exhibits their affinity.

498. With the family of *Suidæ* is probably to be placed the *Hippopotamus*, or River-horse, which seems in many respects intermediate between the pig and the elephant ; whilst its aquatic habits, and the conformation by which it is adapted to these, approximate it to the Dugongs. Only one species is known, which is now confined to the rivers of Middle and South Africa. But for its short, thick, and very blunt muzzle,

it might be compared to a gigantic pig; the body is extremely massive, and the legs so short, that the belly almost touches the ground; and it is destitute of any covering but a few weak and scattered bristles. The canine teeth are long; the upper ones straight, and the lower curved backwards, so that they rub against each other. Although ferocious, or rather courageous, when attacked, these unwieldy inhabitants of the waters are in their nature shy, and feed entirely on roots and other vegetables,



Hippopotamus.

seeming to prefer those which are partially decomposed by the action of the water.

499. The second family of true *Pachydermata*—to which the name of *Tapiridae*, or the Tapir tribe, may be given—resembles the first in the thickness of its skin, but differs in the arrangement of the toes, of which there are only three on each hind-foot, and sometimes also in front, without any central cleft. There is considerable variation in regard to the teeth; but the whole family is exclusively herbivorous. No members of it exist in Europe at the present time; but fossil remains of very large species are abundant in some localities. The *Tapir* of America is about the size of a small ass, with a brown and almost naked skin, a short tail, and fleshy neck that forms a crest at the nape. It is common in humid places and along the rivers, and its flesh is eaten. The nose assumes the form of a short fleshy trunk—the rudiment, as it were, of that of the elephant. Other species have been recently discovered

of a larger size; one of which has the bones of the nose still more elongated, approaching a very remarkable fossil genus—



Tapir.

the *Palæotherium*. This seems to have been an animal nearly allied to the Tapirs; remains of several species, varying in size from a rhinoceros to a small sheep, have been found in the



Supposed form of *Palæotherium*.

gypsum quarries of Paris, the fresh-water deposits of the Isle of Wight, and other places.

500. To this family belongs the *Rhinoceros*, which is remarkable for its large size, and for the kind of horn, composed of a solid fibrous substance, resembling agglutinated hairs, which is supported on an arch formed by the nasal bones. Several species exist in different parts of the tropical portion of the Old World. They are naturally stupid and ferocious, frequenting

marshy places, and subsisting on herbage and the branches of trees. In some species a second horn exists behind the first. The upper lip is generally elongated, and has some power of prehension. Rhinoceroses' bones have been disinterred in many parts



African Rhinoceros.

of Europe. There is a curious little animal, the *Hyrax*, which is about the size of a rabbit, and was formerly placed among the Rodentia; it is, however, little else than a rhinoceros in miniature, without the horn. It is not uncommon in rocky places in Africa and Syria, and one species ascends trees. It is probably the animal spoken of in Proverbs xxx. 26, as the *cony*.



Horse.

501. The third group of Pachydermata, the *Solidungulata*, contains only one family—that of the *Equidae*, or Horse tribe.

Though there is only one apparent toe and single hoof to each foot, there are appendages beneath the skin which represent two lateral toes. The well-known animals of this tribe, the



Zebra.

Horse, Ass, Zebra, Quagga, Onagga, and Dzegguetai, are commonly regarded as belonging to but one genus; but the first of these is probably to be separated from the rest, from the



Ass.

circumstance of its tail being wholly clothed with long hair, whilst that of the rest has long hair only towards the tip.

The Ass and Horse are noted for their usefulness to man as beasts of burden, docility and strength being in them combined in a remarkable manner, but particularly in the horse. In a wild state, the horse lives in great herds, browsing on grassy plains, and occasionally moving over them with marvellous swiftness.

502. All the animals just named agree in their dentition. There are six incisors to each jaw, which, during youth, have their crowns furrowed by a groove, and six molars on each side, above and below, with square crowns, marked, by plates of enamel which penetrate them, with four crescents. The males have, in addition, two small canines in their upper jaw, and sometimes in both; these are always wanting in the females. Between the canines and the first molar there is a wide space, which corresponds with the angle of the lips, where the *bit* is placed, by which alone man has been enabled to subdue these powerful quadrupeds. None of the species of this family are indigenous to America.

503. The Pachydermata are connected with the Manatidae amongst the Aquatic Mammalia, by several genera now only found in a fossil state, but particularly by a very remarkable one recently discovered—the *Dinotherium*. This must have been the largest of the Mammalia not strictly aquatic, its total length being probably eighteen feet. It blends the characters of the tapir and elephant with that of the Cetacea, having probably possessed a trunk and an enormous pair of tusks, directed downwards, though fixed in the lower jaw, and having been deficient in posterior extremities. The tusks, like those of the morse, were probably employed in raking up vegetable matter from the bottoms of the rivers and lakes it seems sometimes to have frequented.

CARNIVORA.

504. The animals composing the ORDER CARNIVORA are separated from the other Mammalia possessing distinct fingers, by the presence of three kinds of teeth, and from these orders they are distinguished by characters which point them out as especially formed for the pursuit and destruction of large animals. They possess in the upper and lower jaw six incisor teeth; a large, strong, and pointed canine tooth on each side; and molar teeth, which are evidently formed for cutting and tearing, rather than for bruising or grinding. The form of these teeth varies, however, in the different genera, in accordance with their several habits. These molars consist of

three kinds: the anterior, immediately following the canines, which are always more or less pointed, and are termed *false molars*; the next class, formed especially for cutting the flesh upon which the animals feed, are termed *carnivorous teeth*; and the posterior are tuberculated, with flattened summits.

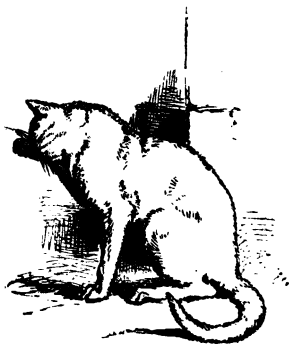
505. The proportion which these different classes bear to each other in number and development, accords with the degree of the carnivorous propensity of the animal, and furnishes important characters in the subdivision of the order. The more the surface of the molar teeth is raised into points and edges, and the more the action of the jaws is restricted to the scissor-like movement by which these edges are made to meet and pass each other, the more purely carnivorous is the regimen of the animal: this is well seen in the Cat tribe. On the other hand, the more the molar surfaces are flattened, and the greater the lateral grinding motion of which the jaws are susceptible, the greater is the probable admixture of vegetable food: this is seen in the Bears. The general structure of the body, and especially that of the extremities, is modified in a corresponding manner, in accordance with the habits and propensities of the animal. In all, the toes are furnished with claws, which are peculiarly sharp in the Cats, and are in them kept ready for use within a sheath, from which they can be projected at the will of the animal. The stomach of the Carnivora is very simple in its form, and the intestines are short, in accordance with the easily digested character of their food.

506. The whole bony and muscular system exhibits a similar modification. Thus, whilst the powerful yet active and flexible movements of the purely carnivorous animals are adapted only to the pursuit and destruction of living prey, the more sluggish habits of most of the Bear tribe, their peculiar mode of progression, and the modified structure of the skull, the teeth, and the limbs, are all equally applicable to the mixed nature of their food. The difference in the conformation of the extremities, and in the mode of using them, is very striking in these two antagonised groups. In the former, the ends of the toes only touch the ground, the heel being considerably raised into the air; in this way, the limbs can be used to much greater advantage in running and springing: the animals possessing this conformation are termed *Digitigrade Carnivora*. In the latter, the whole foot rests on the ground—a structure more favourable to the maintenance of a firm position, but preventing great activity of progression: these are called *Plantigrade Carnivora*. In the seals, which may be considered as Carnivora fitted for a sea-life, there is a third very remarkable variety of conformation in the extremities. Here, as we have seen, the

anterior, as well as the posterior feet, are formed for swimming, being spread into fin-like paddles; and the whole arrangement of their organs is admirably adapted to the pursuit and capture of their scaly prey.

507. The *Carnivora* may be subdivided into four families, each containing a well-known form. 1. *Felidae*, or Cat tribe.—In these the destructive power is most highly developed. They are characterised by their short powerful jaws, their retractile claws, and the peculiar adaptation of their teeth for cutting. They have but one small flattened molar tooth above, and no corresponding one below. 2. *Canidae*, or Dog tribe.—These, like the cats, are digitigrade; but their claws are not retractile; and they have two flat tuberculated molars behind the great flesh-cutter. 3. *Mustelidae*, or Weasel tribe.—These are mostly semi-plantigrade, a portion of the sole touching the ground. They are distinguished by their long narrow bodies, and by the presence of only one tuberculated molar. 4. *Ursidae*, or Bear tribe.—These are the only true Plantigrade *Carnivora*. Most of them possess several tuberculous teeth. In some systems, the *Phocidae* are presented as a fifth family of *Carnivora*.

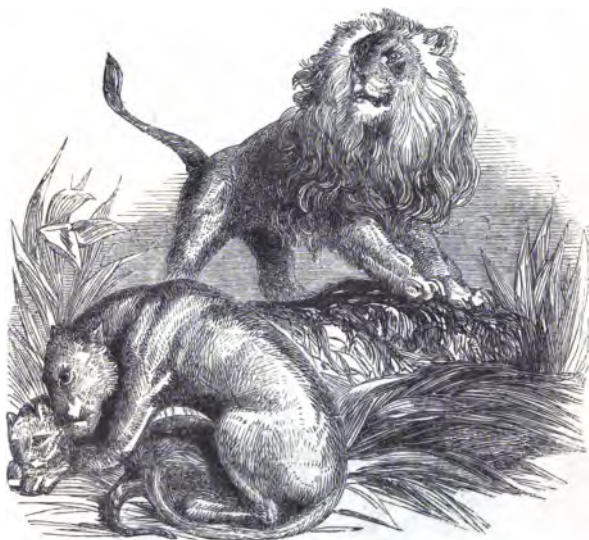
508. The *Cat* tribe includes a large number of animals very closely resembling each other in structure and aspect—so



Cat.

closely, indeed, that many of the species can only be distinguished by their size, and by the markings of their skin. They all agree, too, in the mode of catching their prey, which is to steal upon it unawares, and seize it with a sudden spring, in

which they expend their energy, often slinking off when once baffled. It is very difficult to subdivide the family, on account of the strong general resemblance of its members. Most of them are sufficiently well known to render any peculiar description of them unnecessary. It may, however, be remarked, that some species are found in almost all tropical and temperate countries, and that those of different parts of the globe represent each other in a remarkable manner. Thus, the *Lion* and *Tiger*



Lion—Male, Female, and Cub.

are inhabitants of Africa and tropical Asia; in America, they are replaced by the *Puma* and *Jaguar*, which are confined to that continent. In the same manner, we find the *Panther* and *Leopard* spread over tropical Asia and Africa; the *Ounce*, inhabiting the Asiatic mountains; the *Caracal*, in Turkey and Persia; and the *Lynx*, in Northern Europe. These are represented by the *Ocelot* in South America, the *Lynx* of Canada (differing from the European), and other less-known species. The Felidæ, like the noble falcons, will only eat the flesh of animals they have themselves killed, except when in a

state of domestication or confinement, or when compelled by hunger.



Tiger.

509. The family of *Canidae* includes a much larger number of different forms, some of which approximate to the Cat tribe, and others to the weasels and bears. This tendency to variation from a typical form is most remarkably shewn in the races of the *Common Dog*, which are believed to have all



Dogs.

had the same origin, although the commencement of most of them is entirely unknown. The animals of this family agree in their greater or less adaptation to a mixed diet. Although animal flesh naturally constitutes the principal food of all,

they do not attack living animals with a degree of boldness proportional to their strength; and many of them feed upon carrion, sometimes even when it is much putrefied. The *Wolves*, *Foxes*, and *Jackals*, are the animals which most nearly



Wolf.

approach the dog; and with the first of these it is regarded by many naturalists as being really identical. A very curious



Jackal.

connecting-link between this division of the family and the hyænas is the Wild Dog of the Cape (*Lycaon picta*). This resembles the dog rather than the hyæna in its teeth; but in its tall gaunt form, and general aspect, it is more analogous to the latter, which it is also believed to resemble in internal conformation. It lives in numerous packs, which often approach Cape Town and devastate the environs.

510. The *Hyænas* constitute a group remarkably distinct from the true Canidæ, and yet bearing enough of their characters to require to be associated with them. They are more purely carnivorous than the Dog tribe, and in the deficiency of tuberculated molars, approach to the cats. But they differ

from these, not only in general aspect, which is much more nearly allied to that of the dog, but also in the absence of the retractile power of the claws, and in their propensity to feed on carrion. The teeth are peculiarly adapted for crushing



Hyæna.

bones, and their jaws are shorter than those of the dog, but longer than those of the Felidæ. In many other points of structure, the hyænas are intermediate between the two groups. They are peculiarly ferocious animals, combining the persevering *doggedness* of the one tribe with the furious bloodthirstiness of the other. Their habits are nocturnal—more so than those of most other Carnivora. Hyænas are now chiefly confined to Africa and the south of Asia; but there is no doubt, from the abundant remains of them which are preserved to us, they must have formerly lived in large numbers in this country, and in other parts of Europe.

511. Another curious South African animal conducts us from the hyænas towards the *Civet* tribe, which consists of small animals, some resembling the cat in form, but having two or more tuberculous grinders, and in many instances a plantigrade walk. In the true *Civets*, there is a pouch situated near the tail, containing a secretion of a musky odour, which is valued as a perfume. They are beautiful spotted animals, natives of Africa and India; they are of an indolent disposition, easily tamed, and feed partly on fruits. Allied to these is the celebrated *Ichneumon* of Egypt, which is an animal larger than our cat, and as slender as a marten, sharing in the highly carnivorous propensities of the next family. It chiefly hunts for the eggs of crocodiles, by destroying which it prevents

the excessive multiplication of those reptiles; it is easily domesticated, and exhibits much intelligence; and it is brought up in houses, to keep them free from mice and other small



African Civet.

animals. The ancient allegation of its entering the throat of the crocodile to destroy it, is quite fabulous. The common Indian species is celebrated for its combats with the most venomous serpents.

512. The *Mustelidæ* are the most *bloodthirsty* of all the Carnivora; but they are not so much adapted for devouring flesh as are the *Felidæ*. These animals, on account of the length of the body and the shortness of the limbs, which permit them to pass through very small openings, may be described as *Vermiform*. All the members of this family are semi-plantigrade; and they thus conduct us to the truly Plantigrade Carnivora. The *Weasel* of this country is a very characteristic example of the family; it is one of the most sanguinary of all, but confines itself chiefly to small animals, destroying large numbers of mice, rats, moles, &c. The *Ferret* and *Marten*, which are allied species, are bolder, having been known to attack man; and the *Polecat* is a great enemy to the farmyard, game-preserve, and warren. All these animals have a strong and disagreeably odorous exudation from a pouch under the tail; but it is most disgusting in the last, from which cause it is often called the *Foumart* (a corruption of foul marten). The *Skunks* are an American tribe, intermediate between the weasels and badgers, and are remarkable for the intensity of their nauseous suffocating stench.

513. The *Otters* constitute an aquatic form of this family, having the same general aspect and dentition as the weasels, but being readily distinguished from all other genera of the family by their webbed toes and horizontally flattened tail. They subsist on fish. Several species exist, which are diffused pretty universally over the globe, with the exception of

Australia, where they are replaced by the extraordinary *Ornithorhynchus*. The Indian species is employed for fishing, as the dog for hunting. A large species frequents the waters of the North Pacific Ocean, along the shores of Kamtschatka and Siberia, where it is hunted for its blackish velvet-looking fur. This species is said to feed partly on sea-weed. The *British Otter* also occasionally visits the sea, swimming to



Otter.

some distance from the mouths of the rivers which it has descended. It is said to burrow in their banks; but this is not correct, as it lives only in natural excavations. When the supply of fish is scanty, it has been known to resort far inland, and to attack lambs, sucking-pigs, and poultry.



Polar Bear.

514. The true Plantigrade Carnivora, constituting the family of *Ursidae*, participate in the comparative slow motion

and nocturnal life of the Insectivora; and like them, too, the species which inhabit cold countries pass the winter in a dormant state. In the *Bears*, the cartilage of the nose is elongated and movable, somewhat resembling that of the shrews. These animals possess a great facility, from the



Brown Bear.

structure of the sole, of rearing themselves up on their hind-feet; and this may be especially noticed in such as are, like the bears, fruit-eaters, becoming carnivorous only from necessity; they are thus enabled to climb trees in search of food. The bear also digs the ground in search of earth-worms, on which it feeds, with slugs, snails, small mammalia, and birds, eggs, and vegetables.

515. The *Badgers* (*Taxels* or Badgers of America) and the *Wolverines* form a tribe connecting the Bears with the *Mustelidæ*. The *Badger*, for example, is only semi-plantigrade, and has a dentition very like that of the weasels and otters, but adapted for a less carnivorous regimen. But it has the tardy gait and nocturnal habits of the other plantigrades; it does not, however, become torpid in winter. All these animals, like the weasel tribe, have the power of emitting a fetid odour at will. The European and American badgers burrow with great facility, by means of the long claws of their fore-feet. They go forth in search of food only by night; and devour small animals which fall in their way, and such vegetable substances as roots, earth-nuts, and beechmast, almost indifferently. They are endowed with astonishing strength of jaws, and great muscular force, so as to confer upon them considerable

powers of resistance. Of the Wolverines, the most celebrated species is the *Glutton* of the north, which is about the size of a badger: it is reputed to be very sanguinary and ferocious, subduing the largest animals by leaping on them from a tree. Some species of this tribe approach very closely to the Mustelidæ.

CHEIROPTERA.

516. The ORDER CHEIROPTERA (*Bats*) have been placed thus high in the Animal Kingdom, in consideration of several peculiarities shewing an affinity between them and the Monkeys. They are generally small animals, of insectivorous habits, and their distinguishing peculiarity is a membrane extending over the very elongated fingers of the forearm, enabling them to rise into and pursue their way in the air, in quest of their insect prey. The four fingers, forming the framework of the wing, correspond with those of the human



Skeleton of Bat.

hand, though much prolonged; and there is also a small thumb, terminating in a hook-like nail, which serves the animal for climbing on precipices, and in making its way along the ground. The toes of the hind-feet are short, and furnished with claws, by which the bats suspend themselves

from the trees or walls on which they rest, hanging with the head downwards. From some peculiar sensitiveness in its wing, the bat can make its way, while deprived of eyesight, and even of hearing, among a confused variety of objects, without ever coming in contact with any. In many of the insectivorous bats, the organ of smell is furnished with curious leaf-like appendages, formed of the integument, doubled, folded, and cut into curious and most grotesque forms. The group in which these are most remarkable, is one which avoids the light of day more than others. The arrangement may be considered as an unusual development of the sense, specially useful in those circumstances.

517. The families composing the *Cheiroptera* are arranged in two divisions—one of them including the strictly Insectivorous Bats, the other comprising those which are Omnivorous, or feed chiefly on fruits. In the former, the molar teeth have tubercles, like those of the Insectivora, and the intestine is short; in the latter, the molar teeth have flattened crowns, and the stomach is complex. The Insectivorous group comprises four families:—1. *Rhinolophinae*; in these, the nose-leaf is of complicated structure, and is membranaceous; the index or forefinger has but one joint; the wings are large and broad. 2. *Phyllostominae*, which have the nasal appendage simple and fleshy, and an index-finger of two joints. 3. *Vespertilionidae*, which are destitute of nasal appendages, and have a single joint in the forefinger. 4. *Noctilionidae*, which are also destitute of nasal appendages, but have two joints in the index-finger.

518. To the first of these families, the *Rhinolophinae*, belong the greater and lesser *Horse-shoe Bats*, which are found in the darkest and most secluded retreats of our own country; their name is derived from the peculiar form of the anterior nasal appendage. The family contains many other genera and species, most of which are inhabitants of the Old World. One of the most curious is the *Nycteris*, which has the power of distending the skin, which is very loosely fitted to the body, with air, blown into it through openings at the bottom of the cheek-pouches, which these animals possess. These openings are guarded by a circular muscle, which prevents the return of the air except at the will of the animal; and large valves for the same purpose exist in the neck and back. By this curious mechanism, the nycteris has the power of so completely distending the skin, as to give the idea of 'a little balloon furnished with wings, a head, and feet.' In this manner, the specific gravity of the body is diminished; and some other purpose

may be answered by the contrivance, as in the case of the analogous air-cells of birds.

519. To the second family, the *Phyllostominae*, belongs the celebrated *Vampire*, of the bloodthirsty propensities of which such marvellous stories have been told. The wound inflicted by its teeth is very small; but its tongue is endowed



Vampire Bat.

with a peculiar power of suction, by which a considerable amount of blood may perhaps be drawn. There are no well-authenticated accounts of the death of any animal having been occasioned by this creature; and the story of its fanning its victim with its wings to keep him cool, and render his sleep more profound, is probably a fiction of the imagination. Some of these bats have the tail very short, and in others it is altogether absent. They appear to feed in part upon succulent fruits; but there is one genus, the extreme shortness of whose intestine indicates that it must derive its food from animal matter almost exclusively. One of these has been taken in the act of sucking blood from the neck of a horse. The vampires are confined to South America; but other members of this family inhabit the eastern hemisphere. Many of them attain considerable dimensions; the body being equal in size to that of a magpie, and the wings, when expanded, measuring between two and three feet across.

520. The third family, *Vespertilionidae*, is by far the most numerous, and includes most of the bats of temperate climates. At least thirteen species exist in this country, the largest of which is the *Mouse-coloured Bat*, the expansion of whose wings measures fifteen inches; but this is of rare occurrence. A more common one is the *Noctule*, or Great Bat, which is but little smaller: this is often met with in considerable numbers, seeking its retreat sometimes in the hollows of trees; at others, under the roofs and eaves of houses. Probably the

most abundant is the *Long-eared Bat*, which is easily distinguished by the character implied in its name. Its ears are



Long-eared Bat.

folded downwards during hybernation or profound sleep. It is easily tamed when in confinement, and may be brought to considerable familiarity, so as to eat from the hand. It has an acute and shrill, but not loud cry.

521. The bats of the fourth family, *Noctilionidæ*, are almost exclusively confined to tropical countries. The number of species belonging to this group is very large, but few of them present any important peculiarities. One of the most interesting is the *Cheiromeles*, an inhabitant of Java and Siam, which has a distinct opposable thumb on the hind-feet, by which it can grasp small objects. It is, therefore, an evident connecting-link between the orders Cheiroptera and Quadrumana.

522. The Frugivorous or Omnivorous group contains but one family—the *Pteropinæ*. This is widely diffused throughout warm climates, and contains some of the largest species of the order. It is not improbable that the fabulous harpy may have had its origin in some of these. None of them have the tail much developed, and in many it is entirely absent. The *Pteropus Javanicus* is a very characteristic example of this family. It is probably the largest of the bats—its expanded wings measuring five feet across. It is extremely abundant in the lower parts of Java, and uniformly lives in societies. They suspend themselves from trees during the day; and from their motionless aspect and contracted bodies, they might be mistaken for parts of the tree, or for fruit suspended from its branches. When night comes, they begin to move, and go in search of food to the forests, villages, and plantations; in all of which they do great mischief, attacking indiscriminately almost any kind of fruit, of which they devour a large quantity. In their turn, they are eaten by the human inhabitants of some

of the countries where they abound, who consider them as delicacies. The flesh of the *Common Roussette* of the Mauritius has been compared to that of the hare and partridge.

523. The Cheiroptera inhabiting temperate climates, all remain in a torpid state during the winter. Some of them make their appearance, however, in mild days; but as casual revivals during the season of repose are injurious to them, they usually betake themselves to places of which the temperature is not readily affected by external vicissitudes. The office of this group in the economy of nature, is evidently to assist birds in restraining the too rapid multiplication of insects, and to keep down the luxuriance of tropical vegetation.

QUADRUMANA, OR MONKEYS.

524. The QUADRUMANA have an interest for us beyond most orders of Mammalia, on account of their being the animals nearest to man in external form and in intelligence. They are omnivorous animals, dwelling chiefly in the forests of warm countries, and spending much of their time on the branches of trees, among which they are well fitted to move by reason of the grasping power of their extremities. These are considered by naturalists as four hands—hence the name of the order—each hand having one finger opposed to the rest, like the thumb on the human hand. The two hinder hands, though resembling human feet, are not intended by nature to serve as a support to the entire weight of the animal. It only puts the outside to the ground, and seems awkward and insecure unless it has the fore extremities also employed in its support or in progression. The lowest of the monkey tribe have hands little advanced beyond the feet of the Carnivora, and even among the highest the organ is inferior to what it is in man. A corresponding series of gradations may be traced in the aspect of the face; for whilst, at one end of the series, the muzzle (at least in the young animal) is not much more prominent than it is in some races of man, at the other, it nearly resembles that of other Mammalia. Nevertheless, throughout the order, a certain degree of resemblance to man may be perceived in the gestures, as well as in the general aspect of these animals. All of them, like man and the Carnivora, possess three sorts of teeth; the canines, in the full-grown animal, are much more developed than in man; and there are intervals between them and the other teeth which are not present in his jaws, but exist in all other Mammalia.

525. The *Quadrumana* may be divided into three families—the *Simiadae*, or *Monkeys of the Old World*; the *Cebidae*, or

American Monkeys; and the *Lemuridae*, or *Lemur* tribe, which supply the place of monkeys in Madagascar and some parts of Africa and India. This restriction of distinct types of structure to different portions of the surface of the globe, is not a little remarkable; and it may be traced even in the subordinate divisions.

526. The *Simiadae* must be regarded as the types of the Quadrumanous order; and amongst these the *Apes* manifest, in the most striking manner, the peculiar characters of the group. These are distinguished from the other subdivisions, in part by the absence of a tail, but also by the want of the cheek-pouches and of the callosities, or hard spots on their haunches, destitute of hair, which the monkeys and baboons possess; and further, by the predominance in length of the fore-feet or arms over the hinder ones. The most remarkable species of this group are the *Chimpanzee* and *Orang-outang*: the former, a native of equinoctial Africa; and the latter, of the



Chimpanzee.

peninsulas and islands of Eastern Asia. Both these animals attain considerable size when full grown: the former rising to five feet, and the latter to seven; but no living specimens of those sizes have ever been seen in this country. In both, there is a remarkable difference between the young and the adult form of the skull—the young bearing the greatest

resemblance to that of man, whilst in the adult the muzzle is so much prolonged, and the canine teeth are so much developed, as to give the face much more the aspect of that of the baboon. This difference, together with a change in the colour of the hair, has caused specimens of the Orang at different ages to be accounted distinct species. The character of the animal also changes, being mild and gentle when young, but having a good deal of baboon-like ferocity when come to its full development. In the *Gibbons*, or *Long-armed Apes*, the length of the anterior members is so great, that they touch the ground when the animal is in a semi-erect attitude; these present an approach to the monkeys, in the possession of callosities on the haunches by some of the species.

527. The *Monkeys* of the Old World are distinguished (in addition to the characters which separate them from the *Cebidæ*) by the possession of cheek-pouches, callosities, and a tail, which distinguish them from the apes; the tail is longer than in the baboons, the muzzle less protuberant, and the aspect less ferocious. The group contains, however, some species which present an approach to the apes, and others which form a transition to the baboons. The *True Monkeys* are also remarkable for the shortness of the arms in proportion to the legs, which causes some species to walk on all-fours with difficulty, climbing being their usual mode of locomotion; but by common observers they are still more noticed for the beauty of their colouring, their activity of movement, and gentleness of demeanour. Their character is much changed, however, by confinement. They are found in almost all the tropical countries of the Old World, and particular genera have a peculiar local distribution. Many of them live in societies, chiefly inhabiting the woods, but committing great devastations on any cultivated ground in the neighbourhood. In several species, the aspect of the head is extremely grotesque, as are also the attitudes of the animal. Their food seems to be rather vegetable than animal; and in one genus this is distinctly indicated by the structure of the teeth and of the stomach. Another genus, restricted to Africa, is destitute of thumbs on the anterior extremities, and the deficiency is partly supplied by the great development of the tail, which is not, however, prehensile, as in the American monkeys.

528. The *Baboons* have usually a short tail, or none at all; but there is much variation in this respect. They are rather distinguished from the apes and monkeys by the protuberance of the muzzle, and the ferocity of aspect which is partly dependent upon this; the canine teeth are generally large and strong. The Baboons have also a large bag connected with the

organ of voice, by the resonance of which the power of their loud and discordant cries is greatly increased. The animal commonly termed the *Barbary Ape* is in reality a baboon; but in the almost total deficiency of tail, it bears a superficial resemblance to the former group. A race of these animals inhabits the Rock of Gibraltar, where they manage to obtain a scanty subsistence. This is the only instance of the existence of Quadrumana in a wild state within the boundaries of Europe. The *Mandril* is the largest of the Baboons, and of the Quadrumana in general, with the exception of the chimpanzee and orang. It is a ferocious-looking animal, and is distinguished from other baboons by the bright-red colour of its cheeks; it is dangerous from its size, strength, and uncertain temper, so as even to become a terror to the negroes of Guinea, of the woods of which part of Africa it is an inhabitant. The group of Baboons is almost confined to Africa and Western Asia. Dr A. Smith, a traveller in Southern Africa, states that they chiefly inhabit barren stony places, where they subsist, for the most part, upon scorpions, to procure which they employ their hands to lift up the numerous loose stones, under which one or more of these creatures commonly lie concealed: their stings they extract with dexterity. Baboons are by no means devoid of intelligence; but they do not seem capable of being steadily attached by kindness, and generally exhibit an alternation of moody sullenness and violent outbreaks of passion. Their resentment of injuries is often manifested for a long time afterwards.

529. The Monkeys of the New World, composing the family *Cebidæ*, differ from those of the Old, not only in the greater number of their grinders and a wider disposition of the nostrils, but in the entire absence of the cheek-pouches and callosities, and also in the conspicuous character of the tail, which is capable of being twisted round branches so firmly as entirely to support the animal. In general, the thumbs of the anterior members are not opposable; and they are sometimes scarcely developed at all. The *Cebidæ* are usually of smaller size than the *Simiæ*, none of them attaining nearly the dimensions of the chimpanzee, orang, or mandril; they are also less malicious, more easily tamed, and susceptible of a more constant attachment; but they seem to possess less intelligence. They are found in very large numbers in the woods of South America, where they chiefly subsist on vegetable food, to which their teeth shew a peculiar adaptation. The largest of them are the *Myceti*, or *Howling Monkeys*, which derive their tremendous powers of voice from a sort of hollow drum connected with the larynx (somewhat

resembling that of the baboons), which is peculiar to them amongst the Cebidæ. They are shaggy animals, about the size of a fox. The *Ateles*, or *Spider Monkeys*, are remarkable for



Spider Monkey.

the length and prehensile power of their tails, and for the absence (in some species entire, in others nearly complete) of the thumb; whence they are called four-fingered monkeys. A remarkable link, by which this group is connected with the Simiadæ, is afforded by the genus *Oustitis*, which includes the animals known as marmosets and tamarins. Like the American monkeys in general, they have the nostrils lateral, and the haunches covered with hair, and are destitute of cheek-pouches; but they have only ten grinders in each jaw, like those of the old continent. All their nails, except those of the hinder thumbs, are compressed and pointed, so as to assume the appearance of claws; and even the thumbs, though furnished with flat nails, are yet so slightly separated from the other toes, that the animals can scarcely be called 'four-handed.' The lower jaw possesses large cutting teeth, resembling those of the Rodentia—an order to which this group presents several points of resemblance. They are

all diminutive animals, of pleasing forms, and very active movements; some of them are rather irritable in temper, and present an appearance which is really formidable notwithstanding their size. There is another genus, *Pithecia*, which may be regarded as representing the baboons of the Old World among the Cebidæ; the tail being short, the head large, and the canine teeth much developed. Many of the species are strong, stout, and fierce; having a hoarse and hollow voice, and a malicious aspect. Some of them are nocturnal in their habits, and feed upon small Mammalia and birds, which they steal with great caution and noiselessness; such are distinguished by their large and prominent eyes.

530. The third family of *Quadrumanæ*, that of *Lemuridæ*, has in many respects the general aspect of the American monkeys; but the muzzle is much prolonged, resembling that of insectivorous or carnivorous animals; the teeth, also, are modified for animal food, presenting sharp tubercles, locking into each other; and the grinding motion of the lower jaw is reduced, so that its action possesses more of the scissor-like character of that of the animal-feeders. The four thumbs of these animals are well developed and opposable; the claw-like aspect of the nail of the first hind-finger is one of the most easily recognised characters of the family. The canines in the lower jaw have the character of additional incisors; and the first molars resemble the ordinary canines. The total number of teeth in each jaw is eighteen,



Lemur.

as in the American monkeys. The *True Lemurs* are distinguished by their very large and handsome tails, which are elevated when the animals are in motion, and not trailed after them; they average the size of a large cat, but have longer limbs. They are nocturnal or twilight animals, passing the

day in sleep, rolled up in the form of a ball; at night they rouse themselves, and spring with the greatest activity in search of their food, which principally consists of fruits. They are entirely confined to Madagascar, where at least thirteen species are known to exist, differing from each other but little except in colour. On the other hand, the *Galagos*, which are found in the neighbourhood of the river Senegal, are pre-eminently insectivorous. With this group may be associated a very remarkable animal, which bears a strong resemblance to the sloth—the *Stenops Tardigradus*, or *Slow-paced Loris*, an inhabitant of India and the Eastern Archipelago. It has the teeth of the Lemuridæ, the short muzzle of a mastiff, a slender body, no tail, and large approximating eyes, as in the Lemurs. It subsists on insects, occasionally on small birds and quadrupeds. During the day, it sleeps, clinging to a branch, with the body drawn together; at night, it prowls among the forest boughs in quest of food; its sight is then excessively acute, and it steals noiselessly on its victim. Its grasp is remarkably tenacious; and it has been found that the trunks of the arteries of the limbs subdivide, as in the true sloths, into a net-work of branches, the object of which seems to be to retard the blood in its passage amongst the muscles.



Galæopithecus, or Flying Lemur.

531. In this group are to be placed two remarkable animals, which, from their strong resemblance to other orders, were

associated with them by Cuvier and other naturalists. The first of these is the *Galapithecus*, or *Flying Lemur*, which, from its strong resemblance to the bats, has been arranged with the *Cheiroptera*. It is, however, a *lemur* in all its essential characters; but it has its limbs connected by thin skin, which they stretch out, as the framework of an umbrella supports its covering. By this singular structure the animal is supported in the air, as by a parachute; but it has not the power of sustaining a continued flight, though it can leap a distance of a hundred yards with a gradual descent. Like the bats, it feeds on insects, and sleeps with its head downwards, suspended by its hind-legs. It is a native of the Indian Archipelago. The other of these aberrant forms is the *Cheiromys*, or *Aye-aye*, which, from the peculiar form of its two lower front teeth, has been ranged with the *Rodentia*. In its general character, however, it is essentially a *lemur*; the thumbs of the hind-feet are opposable to the other toes, which is not the case with any truly rodent animal, and approaches to a similar conformation of the teeth are seen in other lemurs. Moreover, it is a native of Madagascar, the centre of this group. It is a nocturnal animal, about the size of a hare: it is said to spend its day in holes in the ground (but these are probably not of its own excavation), and at night to climb trees, from the crevices in the bark of which it picks out worms and larvæ of insects with its long slender fingers.

BIMANA.

532. At the head of the *Mammalia*, and consequently of the entire *Animal Kingdom*, stands the order *BIMANA*, implying *Two-handed Animals*, but in reality composed of but one genus — *MAN*. He may be comprehensively described as a being fitted to live upon almost all kinds of food, and in every part of the earth except those constantly under snow; of an extraordinary intelligence, and tendency to social life; eminent in power over all other animals, and endowed with the greatest ability to turn the objects and forces of physical creation to his own benefit. Besides all this, we believe there is a spiritual being within us, and vouchsafed to no other species, by which we are brought into peculiar relations to the Divine Author of nature, and which will survive the frail tenement in which we live.

533. In this place we have to consider man solely as a part of the *Animal Kingdom*. He is distinguished by an erect posture, and by the two fore extremities being fitted for prehension only, while the two hinder are devoted to support. By the upright

position his upper extremities are left at entire liberty, whilst his organs of sense are most favourably situated for observation. The hand of man is adapted to a far greater variety of purposes than that of the monkeys in which it is most perfect; its power consists chiefly in the size and strength of the thumb, which can have its tip brought into opposition with that of any of the fingers; and all these are capable of being moved separately. In none of the monkeys can the thumb be opposed to the fingers with any degree of force, and in many their tips cannot be brought into contact; so that, though admirably adapted for clinging round bodies of a certain size, such as the small branches of trees, their hands can neither seize very minute objects nor support large ones. To the hand of man some have attributed his superiority; but it may be safely said, that he owes this to his mind and its instruments conjointly. The hand would be useless without the mind to direct it; and mankind, if handless, would soon be reduced to a very subordinate kind of existence, if not speedily extinguished altogether.

534. Man, possessed of so remarkable a means of executing that which his mental ingenuity devises, is less provided, in regard both to acuteness of sensibility and to muscular power, than many other Mammalia. His swiftness in running is inferior to that of other animals of his size. The smallness of his face, compared with that of the cranium, shews that the portion of the nervous system connected with the external senses is less developed in him than in most other animals. Accordingly, he is surpassed by many in the acuteness of his sensibility to light, sound, &c. But he stands alone in the power of comparing his sensations, and drawing conclusions from them. Moreover, although none of his senses are very acute in his natural state, they are all moderately so, which is not the case in other animals; and they are capable (as is also his swiftness of foot) of being much improved by practice, especially when circumstances strongly call for their exercise.

535. This improbability is one of the most remarkable characteristics of the bodily as well as the mental constitution of man. It is owing to a gradual advance in both, that the civilised races now enjoy so much of comfort, and of means of still further elevation. In the processes by which these are attained, we observe a remarkable difference between the character of man and that of other animals. The arts of which these are capable are limited and peculiar to each species; and there seems to be no evidence of a power of invention, or of construction for any purpose, beyond that to which the original and instinctive powers are adapted. Hence

it would appear, that there is no proof of any species or race among the lower animals ever making an advance towards an improvement or an alteration in its condition; and where a particular adaptation of means to ends, of actions to circumstances, is made by an individual—as is often the case where some amount of intelligence or rationality exists—the rest do not seem to profit by it.

536. Man is as much distinguished, then, from the lower animals by his mental as by his corporeal endowments. Yet they are not of a *kind* altogether different from that which we may elsewhere see. In common with the inferior tribes, he possesses strong instinctive propensities, which are kept under control, however, in a well-balanced mind; but when the reasoning powers are undeveloped, as in early childhood and idiocy, the exclusive sway of the instincts is obvious. The more violent passions and emotions are nearly akin to these; and whilst they give great activity to the operations of the mind, it is requisite that they should be duly restrained by the intellect and will. This power of internal regulation is one of the most striking characteristics of the human mind above that of animals, which possess like it reasoning faculties, often to no mean extent, and are actuated by emotions and moral feelings. One of the most important aids to the use and development of the human mind, is the power of producing articulate sounds, or language; of which, so far as we know, man is the only animal in possession. There is no doubt that many other creatures have certain powers of communication amongst individuals; but these are probably very limited, and of a kind very different from a verbal language.

537. The more we study the physical and mental constitution of man, the more are we led to the belief, that it is in the adaptation of the whole to a great variety of circumstances that its great perfection consists. There seems scarcely any condition in which he cannot support himself; he is capable of sustaining the lowest as well as the highest extremes of temperature. Furnished with cutting, canine, and molar teeth, he is clearly fitted for a mixed kind of diet; but he can support himself in health and strength on either animal or vegetable food exclusively. At the same time, it is by the demands which his peculiar condition makes upon the exercise of his ingenuity that his mental powers are first called into active operation; and when once aroused, their development has no assignable limit. On a cursory glance at the condition of the inhabitants of different parts of the earth, it will almost always appear that where food and shelter are the most easily obtained, civilisation is the least advanced. Frequently, as in

many Eastern nations, a certain progress is early made, and the race then remains stationary for centuries.

538. The striking differences in colour, in the form of the head and other parts of the body, and in degree of intelligence amongst the different races of men, have caused some naturalists to regard them as constituting distinct species—that is, as being descended from original stocks having corresponding differences from each other. But this notion does not appear reconcilable with the fact, that in each race there not unfrequently exist subdivisions, of which the characters approximate more closely to those of other races than is ever seen among distinct species. For example, although a characteristic specimen of the Negro race is extremely different from a well-formed European, a series of nations might be traced in Africa whose common origin can scarcely be questioned, and which yet lose one Negro peculiarity after another, until a very close approach is manifest to the character of the white races.

539. Again, it is to be remarked, that the differences among the races of men are such as are observed in other animals to result from the influence of external causes, or to have a spontaneous origin; whilst in those points which most completely separate him from the species most nearly allied, there is a thorough conformity. This is especially the case in regard to his mental endowments; for similar natural prejudices and impressions, the same feelings, sympathies, and propensities, and intellectual faculties corresponding in kind, if not in degree, may be traced in all of them.

540. Nevertheless, the different races peopling the earth may be associated into groups, from their greater or less resemblance to each other; these groups having probably been distinct from a very early period, and their members usually having affinities in language as well as in physical conformation. Five of such groups are usually described.

541. The first occupies Europe and the south-western part of Asia, and may be geographically divided from the second by a line passing eastwards from the Euxine through the Caspian, then following the direction of the Himalaya mountain-range, and descending to the Gulf of Bengal. The two great regions thus separated have been from the earliest periods the abode of two great classes of the human race, differing from each other in manners and social character, as remarkably as the arid and saline plains of Mongolia and the cold desert of Gobi differ from the warm and fertile countries of Southern Asia.

542. To the western group (commonly termed Caucasian) the name of *Iranian* is applied by Dr Prichard, the highest



Caucasian.



Arab Moor.



Mongolian.



Otto Indian of N. America.



Negro (pure type).



Malayan.



Central American Indian.



Bushman (of S. Africa).



Native of Van Diemen's Land.



Native of Tierra del Fuego.

living authority on this subject. The nations composing it people India, Persia, and Arabia, the north of Africa, and nearly the whole of Europe. In the inhabitants of this space, a similar configuration of body may, with few exceptions, be recognised. Of this, the ancient Greeks seem to afford the most perfect model. It is principally remarkable for the roundness of the cranium and the oval form of the face, and for the small proportion which the latter bears to the former, the upper and anterior parts of the brain being chiefly developed. The muzzle does not project, the front teeth of both jaws being perpendicular; the lips are gently turned out, the chin full and rounded. Complexion does not enter into the characters of this group; since it is of all shades, from the white and florid colour of the northern Europeans, to the jet black of many tribes in Libya. In these Indo-Atlantic nations, we find the greatest energy of the intellectual powers and moral feelings, and the greatest susceptibility of improvement by culture. They certainly, therefore, rank highest in the human family. It seems probable that the region of Upper Asia termed Iran, was the primitive seat of those families of nations who have most extensively spread the same type of features.

543. The nations inhabiting the northern and eastern parts of Asia, with the Finnish nations of Northern Europe, and the Esquimaux of North America, evidently belong to a different group (commonly called the Mongolian), to which Dr Prichard gives the appellation *Turanian*. These are particularly characterised by the form of the skull and face, which seem as if they had been flattened in front; so that the features run together. The cheek-bones project very far sidewise; the nose is small and flat; the lips rather thick; the chin less projecting. The characteristic complexion of this group is olive; the eyes are usually black; and the hair black, straight, and strong, but thin. The forehead is low and flat. Their stature is generally lower than that of Europeans; and, with greater acuteness of the senses, they exhibit less intellectual power.

544. The general characters of the Negro races inhabiting the tropical parts of Africa are sufficiently well known. Their complexion and eyes are dark, approaching more or less closely to black; the hair black and woolly. The skull looks as if it had been compressed laterally, so as to cause the face and back-head to project. The forehead is low, narrow, and slanting; the jaws narrow and projecting; the upper front teeth oblique, and the chin receding; the nose is broad and flat; the lips, especially the upper one, thick. It cannot be denied

that in these characters the Negro head is intermediate between that of the European and that of the monkey; but it far more nearly resembles the former than the latter. It is a very important fact, also, that it is only in the most degraded African races that we meet with the *whole* assemblage of characters regarded as distinguishing the Negro; and that in others we find so strong a tendency towards a higher character, that it would be difficult to distinguish many individuals among them from others that might be selected from the Iranian race. The influence of climate, and other external circumstances, on the physical and mental development of the human body, is nowhere more evident than when the degraded nations of the Guinea coast are contrasted with the intelligent Caffres of the south or the civilised Ashantees to the north. There can be little doubt, then, that no decided line separates the African from the European races; and that the former may, in process of time, be brought up to the same intellectual and moral standard with the latter.

545. According to Dr Prichard, the Hottentots and Bushmen, inhabiting the south of Africa, must be regarded as constituting a distinct group, in which human nature is exhibited in its most degraded form. There is a remarkable admixture in their physiognomy of the characters of the Negro and Turanian races. The face is extremely flat; the nose has scarcely any perceptible ridge, and its extremity is greatly widened; the eyes are placed very obliquely, as in the Chinese; the chin is prominent, but very narrow; the complexion is like that of a Negro, diluted with yellow; the hair grows in separate tufts, which spontaneously twist together. In their language, the Hottentots seem to have no affinity with the other nations of South Africa which had a Negro origin; and they live in a more destitute and miserable condition than any other inhabitants of this continent.

546. The aboriginal nations of America, excluding the Esquimaux and some other tribes, form a well-marked division of the human family, bearing a strong general resemblance to each other in their most remarkable characters, both physical and moral. As in the Iranian division, the complexion varies extremely; but in general a reddish or copper hue prevails. The form of the head more resembles that of the Turanian group than any other.

547. The Indian and Polynesian archipelagoes are inhabited by a great variety of nations, which have probably had mixed origins, and which it is difficult, therefore, to refer to any single group. Two races, however, appear to be decidedly distinct from the rest. One of these consists of the genuine

Papuas, or woolly-haired inhabitants of the interior of New Guinea and the adjacent large islands. These bear a strong resemblance to the people of Madagascar. Their hair is less woolly, is longer and thicker than that of the Negroes, but is very different from the lank hair of the Malays and other races. The other, that of the Alfours, appears to have constituted the primitive population of the Eastern Archipelago, but is now nearly confined to the interior of Australia. The hair is not woolly, but hard, black, and thick. The countenance is flattened, and the nose so wide that the nostrils are almost transversely placed. The lips are thick; the mouth wide; and the teeth projecting. The colour of the skin is of a smoky black, never very deep. The stature is usually below the mean; and the limbs seem of disproportioned length. Their physical and mental development appear altogether extremely low.



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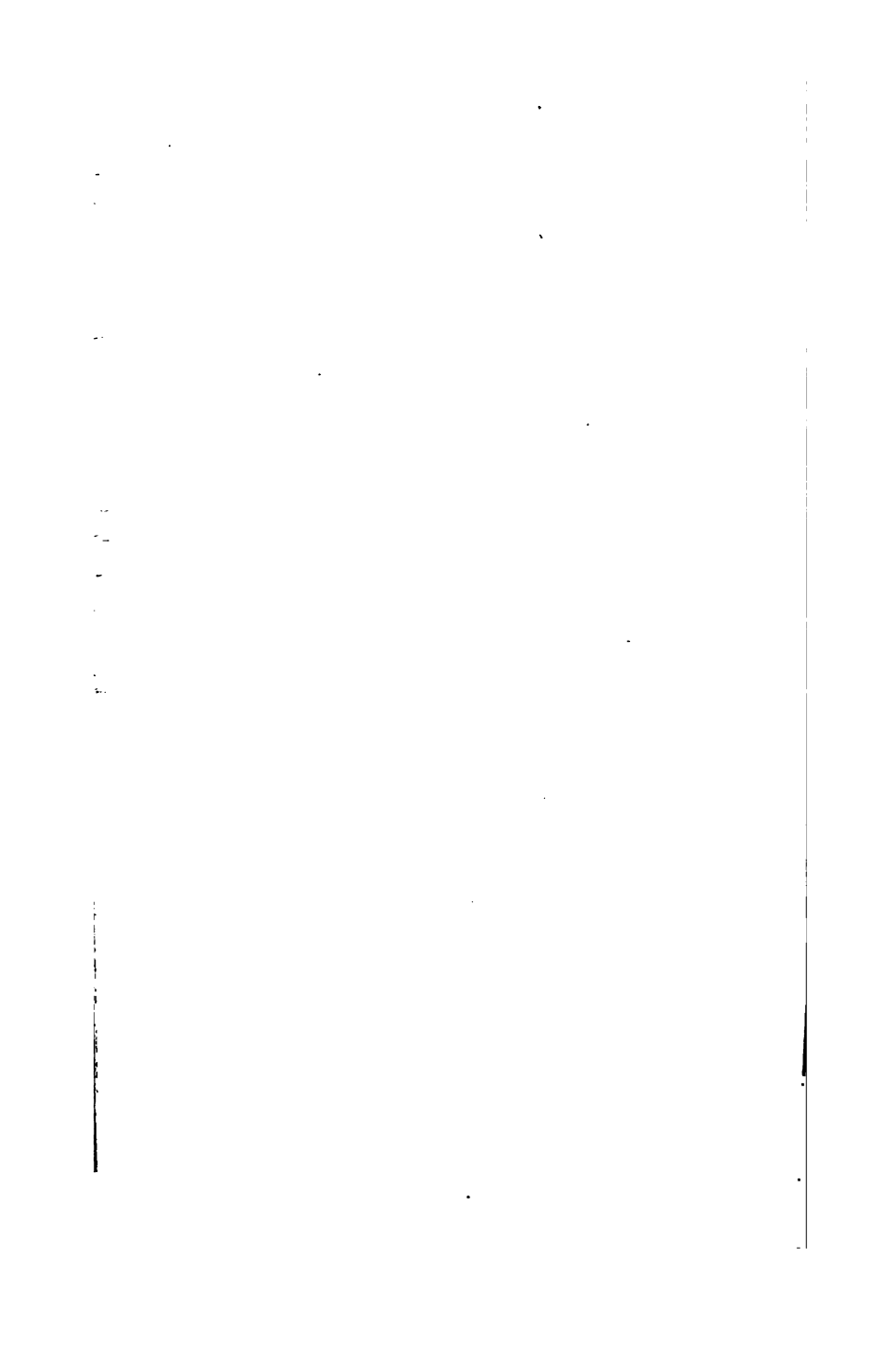
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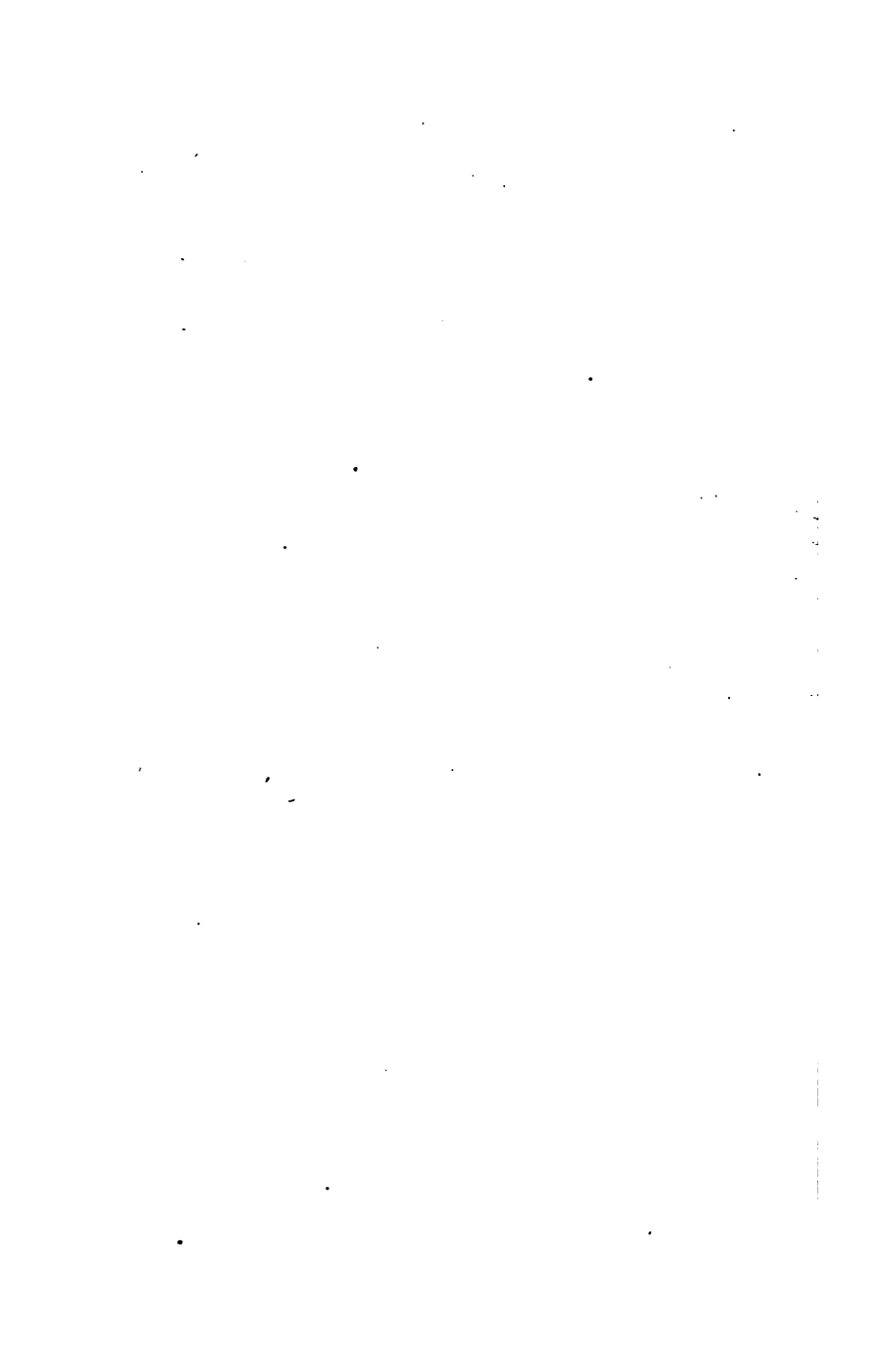
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